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Western Mining in the Twentieth Century Oral History Series

James Henry Jensen

CHEMICAL AND METALLURGICAL PROCESS ENGINEER: MAKING DEUTERIUM, EXTRACTING SALINES AND BASE AND HEAVY METALS, 1938-1990S

With an Introduction by
F. Weston Starratt

Interviews Conducted by
Eleanor Swent
1992

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Since 1954 the Regional Oral History Office has been interviewing leading participants in or well-placed witnesses to major events in the development of Northern California, the West, and the Nation. Oral history is a modern research technique involving an interviewee and an informed interviewer in spontaneous conversation. The taped record is transcribed, lightly edited for continuity and clarity, and reviewed by the interviewee. The resulting manuscript is typed in final form, indexed, bound with photographs and illustrative materials, and placed in The Bancroft Library at the University of California, Berkeley, and other research collections for scholarly use. Because it is primary material, oral history is not intended to present the final, verified, or complete narrative of events. It is a spoken account, offered by the interviewee in response to questioning, and as such it is reflective, partisan, deeply involved, and irreplaceable.

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Chemical and Metallurgical Process Engineer: Making Deuterium, Extracting Salines and Base and Heavy Metals, 1938-1990s, 1993, xiv, 106 pp.

Childhood, schooling in Washington, education, University of Washington, 1932-1938; employment, 1938-1940, Standard Oil of California; 1940-1942, Stuart Oxygen Co., making deuterium and deuterium compounds for Lawrence Laboratory, UC Berkeley; WWII: service in army anti-aircraft artillery, the Philippines; 1946-1977, planning processing plants for acetylene, calcium carbide, diatomaceous earth, potash, phosphates; uranium in New Mexico, Yugoslavia, Argentina. Appendices include supplement by Jensen, 1993.

Introduction by F. Weston Starratt, P.E., President, PR/ade Communications, Inc.

Interview conducted in 1992 by Eleanor Swent for Western Mining in the Twentieth Century Oral History Series. The Regional Oral History Office, The Bancroft Library, University of California, Berkeley.

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PREFACE

The oral history series on Western Mining in the Twentieth Century documents the lives of leaders in mining, metallurgy, geology, education in the earth and materials sciences, mining law, and the pertinent government bodies. The field includes metal, non-metal, and industrial minerals, but not petroleum.

Mining has changed greatly in this century: in the technology and technical education; in the organization of corporations; in the perception of the national strategic importance of minerals; in the labor movement; and in consideration of health and environmental effects of mining.

The idea of an oral history series to document these developments in twentieth century mining had been on the drawing board of the Regional Oral History Office for more than twenty years. The project finally got underway on January 25, 1986, when Mrs. Willa Baum, Mr. and Mrs. Philip Bradley, Professor and Mrs. Douglas Fuerstenau, Mr. and Mrs. Clifford Heimbucher, Mrs. Donald McLaughlin, and Mr. and Mrs. Langan Swent met at the Swent home to plan the project, and Professor Fuerstenau agreed to serve as Principal Investigator.

An advisory committee was selected which included representatives from the materials science and mineral engineering faculty and a professor of history of science at the University of California at Berkeley; a professor emeritus of history from the California Institute of Technology; and executives of mining companies.

We note with much regret the death of three members of the original advisory committee, both of whom were very much interested in the project. Rodman Paul, Professor Emeritus of History, California Institute of Technology, sent a hand-written note of encouragement just a few weeks before his death from cancer. Charles Meyer, Professor Emeritus of Geology, University of California at Berkeley, was not only an advisor but was also on the list of people to be interviewed, because of the significance of his recognition of the importance of plate tectonics in the genesis of copper deposits. His death in 1987 ended both roles. Langan Swent delighted in referring to himself as "chief technical advisor" to the series. He abetted the project from its beginning, directly with his wise counsel and store of information, and indirectly by his patience as the oral histories took more and more of his wife's time and attention. He completed the review of his own oral history transcript when he was in the hospital just before his death in 1992.

Thanks are due to other members of the advisory committee who have helped in selecting interviewees, suggesting research topics, and raising funds.

Unfortunately, by the time the project was organized several of the original list of interviewees were no longer available and others were in failing health; therefore, arrangements for interviews were begun even without established funding.

The project was presented to the San Francisco section of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) on "Old-timers Night," March 10, 1986, when Philip Read Bradley, Jr., was the speaker. This section and the Southern California section provided initial funding and organizational sponsorship.

The Northern and Southern California sections of the Woman's Auxiliary to the AIME (WAAIME), the California Mining Association, and the Mining and Metallurgical Society of America (MMSA) were early supporters. Several alumni of the University of California College of Engineering donated in response to a letter from Professor James Evans, the chairman of the Department of Materials Science and Mineral Engineering. Other individual and corporate donors are listed in the volumes. The project is ongoing, and funds continue to be sought.

Some members of the AIME, WAAIME, and MMSA have been particularly helpful: Ray Beebe, Katherine Bradley, Henry Colen, Ward Downey, David Huggins, John Kiely, Noel Kirshenbaum, and Cole McFarland.

The first five interviewees were all born in 1904 or earlier. Horace Albright, mining lawyer and president of United States Potash Company, was ninety-six years old when interviewed. Although brief, this interview will add another dimension to the many publications about a man known primarily as a conservationist.

James Boyd was director of the industry division of the military government of Germany after World War II, director of the U.S. Bureau of Mines, dean of the Colorado School of Mines, vice president of Kennecott Copper Corporation, president of Copper Range, and executive director of the National Commission on Materials Policy. He had reviewed the transcript of his lengthy oral history just before his death in November, 1987. In 1990, he was inducted into the National Mining Hall of Fame, Leadville, Colorado.

Philip Bradley, Jr., mining engineer, was a member of the California Mining Board for thirty-two years, most of them as chairman. He also founded the parent organization of the California Mining Association, as well as the Western Governors Mining Advisory Council. His uncle, Frederick Worthen Bradley, who figures in the oral history, was in the

first group inducted into the National Mining Hall of Fame, Leadville, Colorado, in 1988.

Frank McQuiston, metallurgist, vice president of Newmont Mining Corporation, died before his oral history was complete; thirteen hours of taped interviews with him were supplemented by three hours with his friend and associate, Robert Shoemaker.

Gordon Oakeshott, geologist, was president of the National Association of Geology Teachers and chief of the California Division of Mines and Geology.

These oral histories establish the framework for the series; subsequent oral histories amplify the basic themes.

Future researchers will turn to these oral histories to learn how decisions were made which led to changes in mining engineering education, corporate structures, and technology, as well as public policy regarding minerals. In addition, the interviews stimulate the deposit, by interviewees and others, of a number of documents, photographs, memoirs, and other materials related to twentieth century mining in the West. This collection is being added to The Bancroft Library's extensive holdings.

The Regional Oral History Office is under the direction of Willa Baum, division head, and under the administrative direction of The Bancroft Library.

Interviews were conducted by Malca Chall and Eleanor Swent.

Willa K. Baum, Division Head
Regional Oral History Office

Eleanor Swent, Project Director
Western Mining in the Twentieth
Century Series

September 1993
Regional Oral History Office
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Western Mining in the Twentieth Century Oral History Series
Interviews Completed, August 1993

Horace Albright, Mining Lawyer and Executive, U.S. Potash Company, U.S. Borax, 1933-1962, 1989

Samuel S. Arentz, Jr., Mining Engineer, Consultant, and Entrepreneur in Nevada and Utah, 1934-1992, 1993

James Boyd, Minerals and Critical Materials Management: Military and Government Administrator and Mining Executive, 1941-1987, 1988

Philip Read Bradley, Jr., A Mining Engineer in Alaska, Canada, the Western United States, Latin America, and Southeast Asia, 1988

Catherine C. Campbell, Ian and Catherine Campbell, Geologists: Teaching, Government Service, Editing, 1989

William Clark, Reporting on California's Gold Mines for the State Division of Mines and Geology, 1951-1979, 1993

James T. Curry, Sr., Metallurgist for Empire Star Mine and Newmont Exploration, 1932-1955; Plant Manager for Calaveras Cement Company, 1956-1975, 1990

J. Ward Downey, Mining and Construction Engineer, Industrial Management Consultant, 1936 to the 1990s, 1992

Hedley S. "Pete" Fowler, Mining Engineer in the Americas, India, and Africa, 1933-1983, 1992

James Mack Gerstley, Executive, U.S. Borax & Chemical Corporation; Trustee, Pomona College; Civic Leader, San Francisco Asian Art Museum, 1991

John F. Havard, Mining Engineer and Executive, 1935-1981, 1992

George Heikes, Mining Geologist on Four Continents, 1924-1974, 1992

Helen R. Henshaw, Recollections of Life with Paul Henshaw: Latin America, Homestake Mining Company, 1988

Lewis L. Huelsdonk, Manager of Gold and Chrome Mines, Spokesman for Gold Mining, 1935-1974, 1988

James Jensen, Chemical and Metallurgical Process Engineer: Making Deuterium, Extracting Salines and Base and Heavy Metals, 1938-1990s, 1993

Arthur I. Johnson, Mining and Metallurgical Engineer in the Black Hills: Pegmatites and Rare Minerals, 1922 to the 1990s, 1990

Evan Just, Geologist: Engineering and Mining Journal, Marshall Plan, Cyprus Mines Corporation, and Stanford University, 1922-1980, 1989

Robert Kendall, Contending with Water in Mines: Shaft-Freezing for U.S. Borax, Inc. in Saskatchewan, 1964-1968, 1993

Plato Malozemoff, A Life in Mining: Siberia to Chairman of Newmont Mining Corporation, 1909-1985, 1990

James and Malcolm McPherson, Brothers in Mining, 1992

Frank Woods McQuiston, Jr., Metallurgist for Newmont Mining Corporation and U.S. Atomic Energy Commission, 1934-1982, 1989

Gordon B. Oakeshott, The California Division of Mines and Geology, 1948-1974, 1988

Vincent D. Perry, A Half Century as Mining and Exploration Geologist with the Anaconda Company, 1991

Carl Randolph, Research Manager to President, U.S. Borax & Chemical Corporation, 1957-1986, 1992

John Reed, Pioneer in Applied Rock Mechanics, Braden Mine, Chile, 1944-1950; St.Joseph Lead Company, 1955-1960; Colorado School of Mines, 1960-1972, 1993

Joseph Rosenblatt, EIMCO, Pioneer in Underground Mining Machinery and Process Equipment, 1926-1963, 1992

Eugene David Smith, Working on the Twenty-Mule Team: Laborer to Vice President, U.S. Borax & Chemical Corporation, 1941-1989, 1993

James V. Thompson, Mining and Metallurgical Engineer: the Philippine Islands; Dorr, Humphreys, Kaiser Engineers Companies; 1940-1990s, 1992

Interviews In Process

Donald Dickey (Oriental Mine), in process

Wayne Hazen (metallurgical research), in process

Frank Joklik (Kennecott), in process

John Livermore (geologist), in process

Langan Swent (San Luis, Homestake, uranium mining), in process

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INTRODUCTION--by F. Weston Starratt

Each person has a unique combination of traits that makes him/her a distinctive individual. You could call them values or talents.

James Jensen has a unique grouping of values and talents that has made him rise to the top of his chosen field of endeavor, mining engineering. But his vision is broader than the extraction of minerals from the earth, and he could have succeeded in almost any field that he had chosen. Jim has been almost everywhere and has been involved in such a wide range of challenging projects and operations that one might think of him as a renaissance man of engineering technology.

My friendship with Jim Jensen goes back almost thirty years, to the early 1960s, when, as an editor of AIME publications, I called upon Jim in his colorful office at Western Knapp Engineering Company in San Francisco. Books and reports were piled high, but Jim, oblivious to it all, knew just where to find everything. His sharp mind more than compensated for the paper chaos that surrounded him.

At that time, Jim was involved in preliminary engineering for Jordan's Dead Sea Potash Plant. We discussed that project and comparable mineral recovery operations in the Western United States, as well as uranium mineral processing operations and a multitude of other projects in which he was involved.

Jim proved to be a most valuable source of information for this editor in countless articles that appeared in AIME's journals over the ensuing decade. Not only was Jim's inquiring mind and breadth of experience a valuable resource, but Jim was also friendly, warm, delightful, and fun to talk with.

Jim has really been a miner most of his life, but with the depression years of the 1930s hovering over him, a degree in Chemical Engineering seemed like a better key to a job than a mining degree. His first job was designing refineries for the petroleum industry, but ultimately, step by step, he made his way back to his first love, mining. Along that route he served in the South Pacific during World War II, where he found his mining bent invaluable in teaching demolitions and the use of explosives to combat soldiers. In active and reserve duty, Jim ultimately rose to the rank of Colonel.

Where did that fascination with mining begin? As a young lad growing up in the state of Washington, Jim lived among the local coal mines that provided fuel for the homes and industries of Seattle and the ships that called at the port. His father did some work for the mining companies, and Jim was intrigued by the underground activities and by the

people who worked there. That fascination reached a peak when Jim's father presented the young boy with a carbide lamp. To this day, Jim never travels without his carbide lamp, which he carries as a symbol of his attachment to the mining industry. That simple act, that gift from Jim's father, impacted Jim's entire life and led to his involvement in almost every type of mining operation in dozens of countries throughout the world.

Jim's experience is absolutely incredible. It is hard to find a country or a type of mineral processing operation that he hasn't been involved with. How many engineers have run a "Heavy Water" plant (of atom bomb fame), as well as calcium carbide and diatomaceous earth plants; built lime kilns and limestone plants; investigated suitable materials for ferro-alloys; managed coking plants; headed engineering and designed saline products plants and a wide range of industrial mineral operation, and he has had some involvement with it.

Some of this ability to design and operate such a wide range of facilities stems from knowing where to get the "right answers," and who to go to ask "the right questions." That sense has been a key to much of Jim's success in these widely diversified projects, not only for the minerals industry, but in other fields as well.

One time, for example, for a project in the Middle East, Jim was called upon to design a large-scale regional laundry. Jim didn't know much about laundries, but after thinking about it a bit, Jim visited all of the laundries that he could find in San Francisco, talking to operators to get their ideas on what worked and what didn't work. Back in his office, Jim designed one of the largest laundries in the Middle East, which may still be working to this day.

Another key to his success has been a "perfectionist" approach to plant design. Jim always wants to be able to go back and be welcome at the plants and facilities that he has worked on.

A positive attitude that says, "You've got to have fun in this life. Sure, you have to make a few bucks, but it is important to keep your equilibrium," has been another key to Jim's success.

To put Jim's contribution to the minerals industry in perspective it is interesting to ask him,

What do you consider your most interesting project? "Probably the uranium plant for Palabora Mining in South Africa."

...the most interesting countries in which you have worked? "Probably South Africa, countries of the Middle East, Argentina, and the Philippines."

...and your most important professional accomplishment? "First, the design, construction, and startup of successful plants in the minerals, metals, and chemical industries. Equally important, the training and development of personnel whose efforts have made it possible to successfully startup and operate these plants."

What is Jim most proud of? "The scholarships that I have set up and the students that I have assisted in their life works."

Finally, how would Jim like to be remembered? "As a man who took care of his people, whose work was his bond, and who enjoyed a full life in a great industry." That says a lot about the man, the engineer, the miner, James Jensen, who has made an enormous contribution to the minerals industry and to the comfort and well-being of his fellow human beings.

F. Weston Starratt, Professional Engineer
President, PR/ade Communications, Inc.

June 25, 1993
San Rafael, California

INTERVIEW HISTORY--by Eleanor Swent

James Jensen was selected for the oral history series on Western Mining in the Twentieth Century because of his varied career as a chemical and metallurgical process engineer who worked with companies on several continents and whose experience ranged from the beneficiation of the oldest and simplest of minerals, such as limestone, to the production of deuterium oxide, uranium, vanadium, and ferroalloys.

Jensen graduated from the University of Washington in 1937 as a chemical engineer and received his M.S. degree there in 1939, also in chemical engineering. He had originally desired to be a mining engineer, and for much of his life he has worked within the mining industry. After graduation he worked for Standard Oil of California and then for Stuart Oxygen Company in San Francisco, where he made deuterium oxide (heavy water) for the cyclotron at Berkeley and became aware of the Manhattan Project to build an atom bomb.

During World War II, he served first with the coast artillery, then for a time with the chemical warfare service, and ultimately with the anti-aircraft artillery in the Pacific theater. He retired from the reserves with the rank of colonel. He speaks often of the brotherhood ethic of the army, and he has transferred this feeling of obligation to one's fellows to his career in the minerals industry. "We take care of our people" seems to be his continuing motto.

Jensen worked for a number of companies before he joined Western Knapp Engineering Company for a twenty-year stint to become executive engineer, designing major uranium processing plants in the Colorado Plateau and Ambrosia Lake districts of the United States, as well as in Yugoslavia and Argentina. He also did much work with potash extraction both here and in the Near East. He discusses this extensive career in his oral history. He has published a number of technical articles on his work, some of which have been translated into other languages.

Born in the Clyde Hill area of Bellevue, Washington, Jim Jensen has sailed since boyhood, and is an active member of the Presidio Yacht Club in San Francisco as well as the Presidio Officers' Club. He is also an active member of the San Francisco section of AIME [American Institute of Mining, Metallurgical, and Petroleum Engineers]. He is a dedicated amateur photographer who gives his talents to these and every other organization which he supports, photographing their meetings and activities and mailing photos to the members. One of his photos of a gold smelting operation in South Africa was so fine that the mining company used it on their calendar.

From the beginning of the oral history series, Jim has attended the presentations of completed oral histories and encouraged and supported the project. He has donated to The Bancroft Library many of his papers, including reprints of articles on heavy water and the Manhattan Project, which have added to the mining archives. He also donated a book on Native Americans of British Columbia, The Story of the Sechelt Nation, by Lester R. Peterson. He presented to the University of California Engineering Department a piece of a petrified mine stull and wedge containing copper threads and carbon-dated in 1969 as 2,285 years old, which had been given to him in Cyprus.

The invitation letter to participate in the series was sent to James Jensen on 3 July 1992, and a planning session was held at the University on 10 July 1992. Two interviews were conducted at The Bancroft Library on 16 July and 5 August 1992. The lightly edited transcript was sent for review in November 1992 and was returned promptly with some additions of factual details and a very few changes in diction.

The introduction to the volume was written by a friend and colleague, F. Weston Starratt, President of PR/ade Communications, Inc.

The tapes of the interviews are available for study at The Bancroft Library.

Eleanor Swent, Project Director
Western Mining in the Twentieth
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June 1993
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BIOGRAPHICAL INFORMATION

(Please write clearly. Use black ink.)

Your full name JAMES HENRY JENSEN (Jim)

Date of birth 8 April 1914 Birthplace Bellevue, Washington

Father's full name Nels Christian Jensen

Occupation Trade-Denmark U.S. Carpenter Contractor Windmill Builder Birthplace Rubjerg, Denmark

Mother's full name Kathryn Ann (Lobban) Jensen

Occupation Housewife Birthplace Fife Keith, Scotland

Your spouse Ollie (cossalter) Jensen (Deceased 12 April 1985)

Occupation Birthplace Feltre, Italy

Your children Nancy Ann, Born 31 Dec 1940

James Donald, Born 5 Sept. 1951

Where did you grow up? Bellevue and Seattle, Washington

Present community San Mateo, California

Education Hunt's Point and Colman Grade Schools. Franklin High School '28-'32
B.S. Chemical Engr'g 1937 and M.S. ChE. 1939 Univ. of Washington. EDP Stanford Business School 1956

Occupation(s) Chemical and Metallurgical Engineer and Consultant, working both on Process, Design, and Construction of Metallurgical plants.

Areas of expertise Petroleum, Compressed Gases, Heavy Water, Calcium Carbide, Coal, Coke, Petroleum Coke, Lime, Diatomaceous Earth, Limestone Mining, Solar Evaporites, Potash, Phosphates, Uranium, Copper, Lead, Zinc, Gold, etc.

Other interests or activities COL Army of the United States, Ret., Commercial Pilot License #1,205,156, Sailing, Mountain Climbing, Fishing, Boy Scout work, Reg. Prof. Engr. CA CH 2023 and MT 0932, and South Africa.

Organizations in which you are active American Inst. of Mining, Metallurgical Engineers (AIME),

I CHILDHOOD AND EARLY YEARS, 1914-1932

[Interview 1: July 16, 1992] ##[1]

Life on a Small Farm near Bellevue, Washington

Swent: Mr. Jensen, let's begin with your telling us where and when you were born and something of your education and background.

Jensen: I was born in Bellevue, Washington, on the 8th of April, 1914, in the so-called Clyde Hill area, which is now a separate little community. In my early days, I went to the Bay School for the first, second, and third grade. It was a little two-room school house at first and then a three-room school house. It was rather interesting to be in there with a group of young people whom you got to know very well from top to bottom. Bringing in the wood to fire the pot-belly stove in one corner of the room was shared by all the students. Those sitting closest to the stove had to keep it stoked. But the instruction in the "three Rs" was outstanding, and disciplinary problems practically unheard of.

I was born on a small farm. My folks had the old-country work ethic, so I ended up at the age of six or seven years old caring for animals and chickens and picking fruits and vegetables and chopping wood and trimming lamp wicks because we had no electricity; and this was the outhouse era.

Swent: Were your parents born in America?

Jensen: No, my father came from Rubjerg, Denmark. My mother came from Fife Keith in Scotland. However, they came to the United States by way of Canada and had property in the northern tip of Vancouver Island, which was then extremely primitive. I still have that

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[1]## This symbol indicates that a tape or segment of a tape has begun or ended. A guide to the tapes follows the transcript.

property. It has big spruce trees on it, eight feet in diameter. Still very, very primitive with bears, cougars, and wolves running around the area today.

Swent: Was your father an engineer?

Jensen: No. The trade that he learned in Denmark was windmill builder. Then when he came to Canada, he worked primarily as a carpenter and was a carpenter contractor most of his time in the United States. He always had hoped to build one of the old-time Dutch-type windmills, but unfortunately the occasion never arose. I think he was a bit frustrated by not being able to follow that early training.

Swent: I suppose the common thread might be that he was working with wind energy and you ended up working with a different kind of energy.

Jensen: Well, we had wind energy too because on our place we had a windmill which pumped the water. My job, when I was about eight or nine years old, was to climb up on the windmill and change the oil in the bearings up in the top.

Operating an Air Engine

Jensen: In addition to the mill we had a supplementary engine which was an air engine. The only ones that I have seen in later years were in Henry Ford's museum in Dearborn, Michigan. This was an unusual type of engine, one version of which was developed by [John] Ericsson, the fellow who built the *Monitor* in the Civil War. It was an easy engine to operate. All you had to do was gather up wood and corn stalks and various other things and fire it. When it got warm enough, I would turn the flywheel over and it would continue to run for as long as one kept firing it. It was a very unusual type of engine. I was always interested in mechanical things of that type.

Then in 1924, the family moved to Seattle. We went via Los Angeles where we lived for a few months. In Seattle, I went to the Colman School where I graduated in 1928. Then to Franklin High School, where I was graduated in 1932. I had taken the college preparatory course which was mostly math and science.

Studying Science at Franklin High School, Seattle

Swent: What was the state of the science that you were studying at that time?

Jensen: The state of science? The state of science at that time compared to today would be called primitive, I believe.

Swent: That table of elements had a lot of gaps in it.

Jensen: Yes, indeed. And the things that happened later in nuclear energy just were not known at that time. But it was very interesting and the courses were good for their day. There was no question about it.

Swent: Did you do any laboratory work?

Jensen: At that time in high school, very limited amounts. Most of the laboratory work was conducted by the teacher; in other words, demonstrations of the various principles that he was trying to illustrate.

I didn't turn out for anything in the way of school sports particularly, other than what I was asked to do in the physical education section, because the place where I was born was all woods and trees. We had so many things to do, we never did play any games, even in school particularly. As a matter of fact, the mark of what was respected by your peers at that time was to be the owner of a nice, sharp hand axe. We used to cut down trees, top them, and fall with them. When I look back at it today, I'm surprised we're still alive. But it was fun and interesting to do.

When I came to Seattle, I worked as a delivery boy, getting the magnificent pay of seventy-five cents for a ten- or twelve-hour Saturday. Later I had a paper route for the Seattle Star.

Swent: What were you delivering as a delivery boy?

Jensen: Oh, that was groceries and things like that.

Swent: Did you drive?

Jensen: No, I was a little bit too young. I did from time to time because it was a Model T Ford truck. I could operate it, but I was too young to get out on a road with it.

Swent: So you just rode along.

Jensen: I rode along. Once in a while I would drive the truck but only for a very short distance.

Swent: You hopped off the truck and went to the kitchen door with the groceries? Is that it?

Jensen: Yes. That was the way it was done in those days. I was paid seventy-five cents a day; we were happy to get it at that time. Those were Depression days in the 1920s, but the 1930s were worse for many.

Helping Father with Carpentry

Jensen: The other thing, too, was that I had to go out on jobs whenever there was time to work for my father from the time I was about six or seven; if only to pick up nails, small boards, and trash. Then I worked more and more into the carpenter activities until when I got into high school I was working on building concrete forms and rough floors and roofs and shingling, wood lathing.

At the age of fourteen--I was just out of grade school at that time--I was put out on a job to raise a house, turn it around and push it twenty feet backwards. The owner wanted to rent my father's equipment, but my father wouldn't allow it to go out unless I went with it. He said [to the man], "You may get yourself killed." So there I was, a fourteen-year old kid, telling a bunch of men who were thirty-five and forty years old what to do.

A young person like that attempting to tell them anything just didn't go over very well. But at least, we didn't have any major problems with it. One of them came pretty close to losing the house by disregarding the instructions for the use of screw jacks and proper cribbing. The point that rankled me was that I received two dollars a day where the skid road crew hired by the owner were paid five dollars.

The other thing that I did when I was at that age, too, was to build a boat, a nice cedar flatty sailboat, and sailed it for several years.

Swent: That word, flatty?

Jensen: That's what we called them, flatty. Not a flat boat with square ends. It was just a flat bottom with lee boards so that you could hold your course, so to speak.

Swent: You did a lot of sailing then?

Jensen: Oh yes, quite a lot; and rowing, particularly if the wind wasn't blowing. It was interesting. The other thing that we did in those years was skiing, mountain climbing, and fishing. That's probably most of it.

When I was graduated from high school, I was about fourth or fifth in a class of about 480 students. I made many friends with whom I still keep in touch. In high school, the scope of my activity in my father's business increased significantly, but I was not interested in the long term of getting into that line of business by any sense of the word.

Swent: It gave you some fundamentals in basic engineering I would guess.

Jensen: Yes, indeed. Also the ability to get along with people, to know what to say and when to say it, to be rather cautious about it.

Considering a Career as a Mining Engineer

Jensen: After getting out of high school, I was going to sign up for mining engineering at the University of Washington. However, in looking around, knowing quite a few people in the mining business, it was quite evident in those depressed days that it was a line of activity that was not very rewarding.

Swent: Was there much mining around that area?

Jensen: There was much mining but the problem was they didn't get paid very much. Whether it was too many of them or just a depressed industry, I'm not too sure. Most of the activity was in coal mines, and coal was shipped overseas from Seattle.

Swent: You did have friends who were mining engineers, you say?

Jensen: Yes, and also I worked with a man who was what they call a "pillar robber" in a coal mine. Most of the mines around there in that country were coal. I worked with him for a bit, and did some surveying and site planning.

Swent: What is a pillar robber?

Jensen: In a coal mine, he takes out the pillars that are left to hold up the roof. Of course, the roof frequently comes down so you had to be rather cautious about which side of it you were on.

Swent: Was this somebody who would lease a property after someone else had finished it and left it? Then he would go in?

Jensen: Yes, he had a mine operation up near Kangley, Washington. I stayed up there with him for a while. I recall we lived in a little two-room shack. In the morning, when we would get up, if the kindling wood was wet, he would light the fire in the stove with a half a stick of dynamite. This used to give me white knuckles at first.

Education in Handling Explosives

Swent: I would think so!

Jensen: I began to realize it just burned like the kindling wood. Of course, if you set it off with a cap, that was another matter. If you were to set off a round that didn't go, we left. We didn't fool with them until the next day. We were very, very cautious because dynamite is something you must be very, very careful about.

But that bit of experience there stood me in good stead even in the days in the military. I was appalled to find out that many of the people just had no idea how to handle explosives.

I also recall another funny story with respect to a gentleman who was the manager of the DuPont Plant, DuPont, Washington. He was addressing a group--I believe it was junior members--of the chemical engineering group. He said, "Well, much of our explosives made here, the dynamite, is sent out to the coal-mining industry. We turned out a batch of powder which was a little different color than our normal material. You know, those doggoned"--he didn't say those words; he was a little more emphatic about it--"miners sent practically every stick of it back." He went on in a very derogatory manner, referring to miners as superstitious.

I said, "Well, Mr. Beers, can I ask you a question?"

"Why yes, young man."

"Did you ever work in a mine?"

"No, what's that got to do with it?"

"It's got much to do with it. I've worked in them. If something doesn't look right, you're not superstitious, you're scared." [laughter] I said, "If I'd looked at it and it didn't look right, I would send it back too."

He didn't like that answer, however; but it is very true. It happened to me years later. I got a batch like that out in New Zealand, when I was in the army, and ended up by telling the colonel that "this material is dangerous and I want to get rid of it."

He said, "What are you going to do with it?"

I said, "I'll burn it." I had the men in the outfit make a great, long trench to put it in, shot some gasoline on it, and burned it. No problem.

A group of the Navy Seabees [Construction Battalion] had received some of this powder and were working on a quarry. They put in a blast with it and five of them went up to see what was the matter with it. I think they buried all five of them in the same garbage can.

Swent: Oh, my.

Jensen: That material was just plain dangerous. Having been brought up in and around the business a bit, you knew enough to be extremely cautious.

II EDUCATION AS A CHEMICAL ENGINEER, 1932-1938

Swent: So then you decided not to go into mining engineering.

Jensen: I decided not to go into mining and went into chemical engineering. I was supposed to be in the class of 1936, but due to the fact that I took military science also, I couldn't make it until 1937. At that time, the Depression was still rather in force so the professor said, "Why don't you stay, rather than go out and try to get a job now, and take a master's? You have enough extra credits so you can do so."

I said, "A little thing like money stands between me and doing that."

"Would you accept a job as a teaching fellow?"

"I certainly would. But how could I get it?"

"You have one now, if you want it."

So this particular job paid the magnificent stipend of fifty dollars a month. I was thinking I ought to buy a car. But it, too, was a very interesting job. Many of the people that I had as students, I am very happy to say, turned out very, very well. I have a letter here from Tony Vittoni who was president of B.F. Goodrich Chemical Company, just one of the very unusually good students. Not that I can take any credit for his ability which existed long before he came to the school. But it is certainly great to be associated with people like that.

Working for the Seattle Gas Works During Vacations

Swent: Did you have any jobs while you were in college? Did you work during vacations?

Jensen: In vacations, yes. I worked for the Seattle Gas Works. That was a job. Another fellow, Walt Barnett, and I were the first two taken by the gas works as students to work in the plant in the summertime. I recall the professor, Dr. H. V. Tartar, saying, "I want you to set a record down there so that gas company will always be looking to the school as a source of people to work in the summer. You are going to make that possible." In those days, his word was law. His recommendation to a prospective employer could mean the difference between success and failure.

So we went down there. These were genuinely dirty jobs that we did, all of them involving shovels, rakes, or manure forks and handling all sort of nasty materials associated with making water gas from coal and coke.

Then an opportunity came to work on the clinker gang. I volunteered to go to that because the other job paid fifty cents an hour and the clinker gang paid five dollars per day plus overtime, which was quite a bit more.

Swent: What did that job involve?

Jensen: That involved a six-man crew who went up to this white-hot furnace, a big opening in the floor. There was a large steel bar about an inch, or an inch and a quarter in diameter, which took four men to hold. You took the bar and beat the clinkers off the walls. It was a hot job. The floors sometimes were so hot that you could throw a board on them and they would catch on fire. You soled your shoes with belting until they were at least an inch and a half thick or your feet would burn up.

Two men would stand right next to the fire and guide the bar. Two men stood on a little platform behind them to add some force to the blow. Two others hung out the window cooling off. We just went round and round and round. When you got the clinkers knocked down then you went below and opened the ash pit doors and reached in there with forks and pulled out the clinkers.

But they didn't want you to pull out the coke. If you pulled out the coke, they made you wet it down, put it back in a wheelbarrow, and bring it up above again to recharge the gas machine.

This was another place that was quite dangerous because they pushed the furnaces with oil to increase the gas output. Sometimes the oil would run down into the ash pit and you would have an explosive mixture down there. So again, you had to be extremely cautious.

You developed an eye for these things. Of course, you had colored glasses, everything was totally enclosed, you wore all woolen clothes so you wouldn't catch on fire. You could look in there and quickly you got to the point where you could tell coke from clinker. Just only take the proper one out, and save a lot of hard work.

When you opened the lower ash pit door, you opened it with a long bar. The doors were about this wide and this high. [demonstrates with hands]

Swent: About four feet wide and two or three feet high.

Jensen: You would retreat behind the door, a big heavy steel door, to make sure the thing wasn't going to blow. If it had a little fire in it, you didn't worry, because the gas was burning, and that was safe.

I recall one night we opened it and didn't see anything and looked very carefully, and the other fellow said, "It looks safe." We walked up to it and we were practically knocked down with the blast. But his clothes caught on fire, as he didn't have all wool clothes on, so I put him out with a garden hose. You throw up your gloved hands so you won't catch the flames in your face and don't breathe; that's important at that point.

We didn't get hurt but it was one of those jobs that if you weren't cautious, you could get in real trouble. Fortunately, at the end of the summertime job that we had there, Pat Hinton, who was the yard foreman for the Seattle Gas Works, was sufficiently convinced that we were a real good crew, that from there on they hired people from the university. We were proud of the fact that we had established some sort of a record with them.

Working at the Salmon Cannery at Astoria, Oregon

Jensen: The other job I had one summer was working in the salmon cannery in Astoria, Oregon, making salmon oil which was used as an additive for the canned fish. You see, salmon changes color during the year. Early in the year it is very pink; late in the

year it is very pale. So in the early part of the season, we boiled down the eggs, the heads, the backbones, or any other portions of the fish, and made a red oil in the spring which was put into the fall fish. The fall oil was put in the spring fish of the next year so that evened out the pack color and oil content.

This required some chemical work because we had to be extremely cautious that we didn't allow the oil to become rancid or develop tastes or something that could cost thousands of dollars in the pack. So we had to run a lot of chemical tests on it and be extremely careful that it met food grade requirements.

Swent: You were doing that?

Jensen: Yes. They weren't difficult tests. Both ours and the Alaskan fish packs were given the beta methylindole test. This is a test on the canned fish to make sure it wasn't decomposed, in effect. We never had any trouble because this particular cannery was so clean, you could eat off the floor.

Swent: Which cannery was it?

Jensen: It was the Elmore Cannery of the Columbia River Packing Company in Astoria, Oregon. It is no longer in existence, as 1936 was the last major salmon run in the Columbia, four years after Bonneville Dam was closed off. In those days, there were as many as three thousand boats fishing. Now you can't find a boat anywhere. Only those in the Columbia River Maritime Museum.

Swent: What sort of chemical tests were you doing?

Jensen: On the oil?

Swent: Yes.

Jensen: It was to determine whether it had oxidized or turned rancid. It was not a particularly difficult test to do. The other one, the beta methylindole test, was one that we normally didn't do. It was generally done by the government to check your pack. If, as in some of the canneries up in Alaska, sometimes they didn't make it, then they had a choice: either destroy all the pack of that lot or open every can and heat it and have a smeller pass it. Those passing could be resoldered, others had to be destroyed.

We had a smeller in the cannery, and he smelled fish because we tried not to can any fish that was out of the water more than twenty-four hours. There is an easy way to tell. When you open the fish after it has been cleaned, you bend it. If it cracks,

you smell it. If it didn't smell good to the smeller, he just threw it down in a box where it went down to a plant that made fish oil for paint, fertilizer, and stuff like that, which you could also smell ten miles away.

It was an interesting job and a fun summer. I had a chance to see the old-time fishing using what are called beach seines, the big nets which were 4,500 feet long and set out by a tug. After they had run their drift, out in the river there was a bunch of barges in which there was anywhere from eight to fifteen horses. When the tide went down, the barges grounded. They would drive the horses out into the water almost neck deep, hook on the net and drag it ashore. I imagine in the early days, it may have been done by manpower but horsepower was a lot better. You would see them sometimes get ten tons of fish. Then other times they would get five steelhead two feet long or something like that. The luck of fishing! A method of fishing now long gone. Other fishermen used 1,500-foot seines from small boats or trolled as is still practiced widely on the California coast.

Then while I was there, I was a member of the Astoria volunteers. We went out to attempt to take the bodies off the Iowa when it sunk off the north jetty in 1936.

Swent: This was a ship?

Jensen: The Iowa was a ship of the States Steamship line. They may have lost others besides one off San Francisco, but I remember the Iowa best. It was very distinctive because there was not a man saved on it. Everyone was lost. Unfortunately, we were not able to get any bodies.

We had some pretty wild experiences. One of the fellows who went out with us was a reporter for the Oregon Journal, I believe it was. He wrote a story up which I still have a copy of because he was certain he was going to drown. His was a pretty wild story.

We were hoping only to recover the bodies, which for some reason they were interested in getting. Normally, personnel that are lost on off-shore boats down there would report in what we call Dead Man's Cove which was a place where currents bring them in. We had the county coroner, Benny Colman, along. I asked Benny, "How many did you get?"

"I got five out of Dead Man's Cove, but the rest of them were scattered up the beach for miles."

So in coming back on the first trip, the engines on the boat, the Selma S. of Ilwaco, quit right off the famous Peacock's Pit. We thought we might be going to join the unfortunates too. Old Uno Svenske was the skipper, down tinkering with the engines; he yelled up, "How far are we from the beach?"

I said, "I don't think we are more than two or three hundred yards. We are pretty nearly in the breakers."

He said, "Yiminy Christmas." He didn't say that but he said something more emphatically. "Have Hans throw the anchor overboard." We threw an anchor overboard and it dragged so we threw another one over and it held. He got a couple of licks out of the engine and we got offshore a little further where it was safer. He climbed up on the mast and hung his pants up there waving in the wind. This is a certain sign of distress. Then we watched, with a pair of field glasses, the coast guard tower at the entrance out there. We saw them wave the flag at us. Soon after the coast guard cutter came out and ignominiously towed us back to Astoria. Two subsequent trips were less scary, but conditions too difficult to cope with safely.

III ENGINEER FOR STANDARD OIL COMPANY OF CALIFORNIA, 1938-1940

Swent: So you got your master's degree in 1938?

Jensen: I was to have graduated in 1938, but the date of the master's was 1939 because the printing and the various things that had to be done with it were not done in time to get in on the 1938 graduating class. So I had this opportunity to go with Standard Oil Company and in those days that was considered one of the better jobs. Another of the bachelor graduates of that day had an offer to go to work as a chemical engineer in one of the paper mills for seventy dollars a month and he was happy to get it. Others went down on the Columbia River and started at eighty-five dollars a month and at the end of the year might be up to $100 or $105. That was almost the end point for those jobs. They were not attractive jobs, unless one remained to become technical director.

Although many fellows did hang on and ended well up in the paper industry, it was a very difficult start. So, I came down to San Francisco to Standard Oil Company and joined the engineering department, then located on Bush Street.

This particular engineering department did the design work for the plants that Standard built at that time; not only the design work, we also did all the construction ourselves. It was at that time completely done within the company.

However, as the company found out, they had these peaks and valleys in personnel requirements between jobs. This became extremely difficult, so in later years, shortly after I left, they then began to farm out the portions of the engineering, the detailed engineering: the construction to contracting organizations like [Ralph M.] Parsons, Bechtel, Fluor, and other companies of that type who were prominent in the industry, at least here in the West.

By so doing, they then retained a nucleus of people who did the basic thinking, you might say, the process engineering on the plant, from which a company could take the data and develop the design and construction. However, the contractor was also monitored by representatives from the Standard Oil Company engineering department. They didn't just let some contractor go in there and start in without a supervisor. Although they might make great representations about their ability in the business, it just didn't always work out that way.

At that time, I worked not only in the engineering department, but also with the chief fire protection engineer, and others. Then I was supposed to go to Arabia because I had done design on the lead sulfide treating plant for the Ras Tanura Refinery in Saudi Arabia. That was a new refinery being built at that time, and there was a need for field construction supervision and startup of the treating plant section.

That was in 1939, and a group of us were set to go out there, about twelve or fourteen of us, as I recall. I went into the office to pick up a few things. I was sitting at the phone ready to call an express company to go and get my baggage when the assistant chief engineer, Pres Wright, came out. He said, "Oh, you haven't left yet."

"No, but I'm on my way."

"Oh, no, you're not. You just unpack everything and stay right here."

"What is the problem?"

"Something terrible is going to happen."

"What about the other fellows in the group?"

"Except for two, I've caught up with all. You were the one I was still looking for up until now. The other two, I don't know where they are. I hope they are not lost to us."

But he wouldn't say just why this was true. However, Hitler marched on Poland a day or two later. The two that got away took a long time to get out there, because they were going through essentially what was a war zone in many places, to get to Arabia.

Swent: How did they travel?

Jensen: In those days we took a ship, usually to England. I was going to go to England to look at some equipment for Arabia. Then to Paris

and take the Orient Express to Istanbul. From there, one took what they called the Taurus Express out to a place--I believe it was Tel Kochek, Syria. Then it was a desert motorized caravan that took you across to another town, Kirkok, Iraq. Another railroad then went on down to Baghdad, and on to Basra, at which point you picked up a small ship that took you down to Bahrain. From Bahrain there was a smaller boat that would run you over to Saudi Arabia.

It was quite a trip. I kind of hated to miss it. Under the circumstances, probably it was just as lucky.

Swent: But the two other men did make it?

Jensen: Oh yes, they made it all right. They probably wished afterwards they hadn't.

Swent: Could be. But you were spared that, so you stayed here.

Jensen: Well, at one time they did have England-to-India air service which did stop in Muharrac Airport, Bahrain. But after things got kind of touchy in the Middle East, they wouldn't take many passengers. Some people did have an opportunity to take that flight but I never did.

The British had a strip there. During the war, it was used as a fighter base. When the Italian planes came down, they were going to bomb the place but they didn't hit much. This was what the fellows out there told me. I said, "But why in the world didn't they scramble the fighters and get them up there to intercept those bombers?"

They said, "The whole fighter crew was up in the club, drunk. They never got off the ground." I'll bet they wouldn't want that revealed about themselves. But fortunately the bombers did no great damage. They broke a couple of water lines and returned to their bases, never to return. That was about the size of it.

Working for Standard Oil Company in an overseas job like that, they gave you a detailed syllabus detailing all the data needed to support your movement and position. It's almost like being in the army. There were things you could do and couldn't do and you did not involve yourself in any way with the politics of the country. You stayed to yourself and obeyed their laws. Many of the men who went out there learned Arabic and got along quite famously. But the company was always circumspect in its relationships with the principal people in Saudi Arabia, and for years, it was very smooth. Everything worked nicely. I borrowed

the syllabus system for later overseas projects at Western Knapp Engineering.

Later, I had a friend who went to work for Aramco, and I told him, "It's a wonderful company. You'll do very well, I'm sure. But when the people in Washington get to fooling around our there, we're going to lose it. I hope you are able to retire before that happens." He made it, but it's probably not as good now. It is extremely different, I'm sure.

IV STUART OXYGEN COMPANY, 1940-1942

Making Deuterium and Deuterium Compounds

Jensen: Then, from there, I went to the Stuart Oxygen Company. The reason I went to the Stuart Oxygen Company was that one of the assistant chief engineers, Mr. Ernest F. Goodner, who later became president of one of the Standard Oil divisions, and is still a great friend, went down to work with the people in the Stuart Oxygen Company to assist them through some agreement in the management end of the company.

Ernie went to Stuart. After he had gone down there, the fellow who was then operating the heavy water plant, a man by the name of T. R. Eller, was preparing a deuterium chloride solution, in anhydrous methyl alcohol, kept at the temperature of dry ice; in other words, extremely cold. Unfortunately, during the course of his work, something happened and nobody ever really knew what it was exactly, but he had an explosion and it killed him.

Swent: Deuterium had just been discovered, hadn't it?

Jensen: Yes. Not too many years before that. Heavy water, deuterium oxide, was a relatively new discovery. But people were making chemical compounds and deuterium gas used in the cyclotrons. The company made them in San Francisco.

So Ernie called me up and told me about the circumstances and said, "You being a chemical engineer, this is the background we need here. Would you be willing to come to work in the plant?"

Then he offered me a much more handsome stipend than what I was receiving up at Standard. I said, "Yes," although my wife was not too enthused about this change.

She said, "Oh, Standard is a wonderful company." I said, "Right." She knew the many people there and they were great

friends and all. She knew it was a place that had a long-range potential. She was quite concerned about Stuart.

But, it was an interesting challenge. After I joined Stuart, I got a hold of the university that wanted this deuterium chloride prepared and asked them if they still wanted it. They said, "Yes," but the management of the company said, "Well, you don't have to make it, if you don't want to."

I said, "No, we should make it. I think I know what the man did that led to his problem." So we did; we never had any further trouble.

Then, of course, we supplied heavy water in small quantities to laboratories all over the United States, and to the University of California cyclotron.

Swent: What were they using it for?

Jensen: A lot of the work was, of course, classified. Nobody ever talked about too much. I remember the Howe Lab of Ophthalmology back East there used to buy it. I don't know what in the world an ophthalmology lab would use heavy water for, but they had some particular use for it.

Swent: What is the relation between deuterium and heavy water?

Jensen: Heavy water is just deuterium oxide. Deuterium is the second isotope of hydrogen. The first isotope is hydrogen, then deuterium, and the third one is tritium, the one you hear, or did hear, so much about with respect to the hydrogen bomb.

Swent: It seems to me, in some of these things I was reading, they were using heavy water and deuterium interchangeably.

Jensen: Yes. It frequently happens that way.

Swent: Also, sometimes it was liquid and sometimes a gas. Is that correct?

Jensen: Well, the gas is just like when you electrolyze water, you get off hydrogen gas and oxygen. When we electrolyzed heavy water, we got off deuterium gas and oxygen. The deuterium gas, then, much of it was sent over to Berkeley, to the cyclotron, because that unit accelerated those extremely small particles. It was a proper mass to be effective in their work, hydrogen being a bit too light and the next one, helium, would be probably too heavy, so it was something that they needed.

Swent: And they couldn't make their own?

Jensen: No, not in the concentrations required, over 99 percent. It took a bit of special knowhow to make it. They tried making it on the Berkeley campus by distillation, but they could only get up to about 30 percent and most of the time, they need about 90-97 percent or better deuterium gas.

Contacts with the Lawrence Laboratory at Berkeley

Swent: Did you have any contact with the people over here at Berkeley at the time?

Jensen: Oh yes. The one I remember best was Dr. Cooksey, who was one of Lawrence's people and then, I did meet others who showed me the cyclotron and explained its operation. This was just a matter of curiosity on my part, because for those days that was an enormous piece of machinery. I recall that there were 5,000 tons of steel in the magnets. That's as much steel as you have in a good-sized ship. There was something like 220,000 pounds of copper bar winding that was used to get the tremendous magnetic effects that were needed for this particular unit.

Swent: You were allowed to just come in and look at it?

Jensen: Oh, yes, but cautiously!

Swent: Did you have to have any kind of security clearance?

Jensen: No, they never did assign any type of security to anybody at that time. In those days, this was more like a curiosity. Everybody was very friendly about the whole thing. Since we were supplying the heavy water, they were friendly in that regard.

I do recall that then the Norwegians got into the heavy water business, having this tremendous hydrogen plant at Norskhydro's operation there in Norway. They had an opportunity to recover heavy water, which is present in most of the waters of the world, about one part per five thousand or so.

Swent: I noticed it says there is heavy water in San Francisco Bay.

Jensen: Oh yes, but we used just the tap water. It's all around us. It's very common. Tritium is different though. You don't find that too frequently in nature as it is radioactive.

The Norwegians then got fully into the business. Since they had such an enormous capacity for heavy water, they were able to make it a bit difficult for us competitively. So for a while--I think Mr. Patrick Coyne, president of Stuart Oxygen at that time, at various times was considering closing the plant because it was not a big part of our operation. However, I think it was a matter of ego with his Bohemian Club friends that he could talk about that heavy water and nobody else had it.

Swent: But could you ship things, at that time, from Norway?

Jensen: Oh, yes. It shipped well in glass ampoules, or bottles for the water and pressurized in steel cylinders for the gas.

Swent: This was before the war.

Jensen: Yes. Then after the war started, of course, things became very trying, at least for the Norwegians. I was told that the last shipment of heavy water came out of Norway on a submarine. Then Hitler took it over. The Germans, of course, were working on the atom bomb as, to some extent, were the Japanese. Then, of course, the U.S. supply of heavy water became difficult. There was nobody left, except our company in the rest of the world, as far as I know, that was producing it. At one time, there was a company, Ohio Chemical, in the eastern United States that made small quantities of it, but had discontinued production. Our quantities were small too, about a liter a month.

After Hitler took over, the next thing I knew, I had a stack of "ship at once, ship at once, ship at once" orders from people I had never heard of in the United States.

Swent: This was when? This would have been in 1942?

Jensen: About 1941 and 1942, just after Hitler took over there. Actually, the other thing that happened was we even got an order from the Japanese. However, I declined to ship to them. I went up and talked to the president, Mr. Coyne. I said, "Mr. Coyne, we have this order to the Japanese and I would prefer not to ship it."

Swent: This was before Pearl Harbor, I presume.

Jensen: Oh yes, long before Pearl Harbor. I said, "Based on our work, we have reason to believe that there is work going on in the world that, should these people achieve success, is going to be inimical to the best interests of the United States. Since I am in the army reserve, it might be quite inimical to my well-being too."

He said, "If you feel that way about it, we don't need the business, do we?"

"No."

"Tell them we don't have it." So we did.

Swent: How did you become aware that this was being used for weapons research?

Jensen: We knew that people were working on the atom bomb because heavy water/deuterium entered into those reactions. Part of the work was done here at Berkeley, although people were very, very careful about talking about it, of course. After the government caught on to it, you might say--.

Swent: Do you recall how you became aware of this?

Jensen: Probably more by reading and seeing what was going on, and my assistant, Henry Eddy, was very knowledgeable on atomic theories. At that time, of course, the question was, "Could an atomic reaction or splitting be achieved, how, and under what circumstances?" The potential seemed to be there but were we intelligent enough to figure it out?

Swent: The potential for splitting the atom.

Jensen: Yes, for an atomic reaction, which would be, as it turned out for those dropped on Japan, catastrophic to those who receive it. So we were fairly aware of the potential. Somewhere in my stack of papers here I have a clipping appearing after the war, in which the Japanese said that one of the reasons that they were not too successful in their efforts was that they couldn't get the proper raw materials. Maybe we contributed a bit to that possibility.

When Hitler took over the plant in Norway, efforts were then made by the Allies to destroy the plant and also any of the materials that they could find. I think between the guerrilla forces and other forces, they succeeded in neutralizing it so they didn't have too much of a supply.

Swent: Did you take any precautions against sabotage here?

Jensen: Well, really not. After I left and went into the army, they put strict secrecy and guards around the place, so I was told. The only time I had a problem with somebody attempting to compromise it was when Mr. D. J. Will, the vice president and co-owner of Stuart, said, "I have a man who would like to come down and work with you. He is going to school at the University of California."

I said, "Oh fine, send him over." I took one look at him and I decided there was something wrong with this situation. He didn't want to work for me at all. He wasn't interested in that. The question was, he wanted only to know how to make the heavy water. After a bit of exploratory chatting with the man, at which time I found he had a Ph.D. (he just wasn't an ordinary student), I said, "Well, I don't know if we are ready to have anything for you today; but why don't you run along and we'll consider it."

I called Mr. Will, the vice president, and said, "If you would like to give the plant away, you've got a taker, but he isn't going to give you anything for it." He decided he didn't want to give it away, so we wrote the applicant off. Today he would probably sue on the basis of discrimination of some sort, but he spoke perfect English, although I don't recall if the question of his being a U.S. citizen came up.

People were interested in getting into the heavy water business in any way that they could. After the supply from Europe was cut off, I recall that Dr. Cooksey called me up and he said, "Jim, I would like to come over and visit with you in the plant over there."

I said, "Fine, Doc, come on over." He came over and I was quite intrigued with him, a typical college professor and very friendly.

He said, "I'm very worried."

"What are you worried about, Doc?"

"I'm worried about our source of heavy water. You must have a lot of problems meeting the requirements here in this country."

"I do. Look at that stack of orders on the desk; people I have never seen or heard of."

"What I want to know is where do I stand with the cyclotron at the University of California?"

"Well, Doc, I like my job here. It's a fun job, interesting and challenging. I want to tell you something else about this job. When things were tough and the Norwegians just about had us broke, you continued to buy from us. If you had not done that, we wouldn't be talking here. I would possibly be out looking for a job or working somewhere else. But as I say, I like my job, so here is the situation that is going to exist. Doc, you are going to get yours if no other you-know-what in the whole United States gets another damn drop. All you have to do is give me the word,

and I'll burn that stack of papers right there. We take care of the people who took care of us (the old army rule) and you are in that class."

"That's what I wanted to hear."

I then prepared a form letter to all those people who sent orders to us. In it was, "Sorry, unable to meet your requirements. Please refer to the former supplier," [laughs] knowing full well that place was blown up and gone. They probably were pretty unhappy.

And we did continue with that very fine relationship. Of course, they saved me too, because as a first lieutenant in the army reserve I got orders to go to active duty in the military. This was before Pearl Harbor and the loss of the Philippines. I had been around the military enough to know that something was going to happen. I knew, as did my associates, that it was going to happen as far as the United States participation was concerned. Sometimes it isn't good to be in there too early. I got the orders to report so I called them up at the cyclotron and said, "Look, if I report in to the army, you might just as well write off the heavy water supply." They decided this wasn't too good, and obtained a year's deferment which saved me from Bataan and the Death March.

I had acquired a graduate, Henry Eddy, from the University of Washington in chemical engineering; he came down and worked in the plant and learned the business. An outstanding man who carried on after I left for the service. I felt then and always will that I owed something to my old buddies of the reserve.

Swent: You were limited in how much deuterium you could make?

Jensen: Yes. We had a small plant in San Francisco and no way to rapidly add capacity or increase production.

Planning for the Heavy Water Plant at Trail, British Columbia

Swent: Why didn't you enlarge it?

Jensen: It was expensive, but about that time, I got a letter from Dr. Egan B. Murphree, who was the head of the OSRD--Office of Scientific Research and Development. Murphree was a chemical engineer, prominent in a lot of research activities in the United

States. What he wanted to have was the cost of a tremendous heavy water plant.

So I went up to Mr. Coyne and said, "Mr. Coyne, I would like to give this man an answer because we have reason to believe there are big things that are going to happen in the atomic business. Our company could be in on essentially the ground floor of it. This could be very helpful from a financial standpoint."

He said, "Give him an answer but don't give much time."

"Yes, sir."

I carefully prepared an answer. However, I was also very careful to give only numbers, no drawings, no great discussions of how things were done or anything else. Just from the numbers they probably would have a bit of difficulty just finding out what we were doing.

The next thing that happened, I got a call on the telephone. It was Dr. Thiele who, in the chemical engineering groups in the United States, was considered probably one of the top people both in academic circles and the industry. He was from the Massachusetts Institute of Technology [MIT] and was well known. He said, "We have Murphree's data that you sent in and we would like to come out and talk to you."

I said, "That's fine. I have to go up to the Northwest for a few days but will be happy to meet with you."

Dr. Thiele said, "This has to be a very, very small, closely controlled meeting. There will be four people on our part: myself, Dr. Frank Barr--" (who was later the head of research for Esso; he may have been at that time as a matter of fact) "--and a fellow by the name of Ernie Mason, a design engineer for COMINCO, in Trail, British Columbia, and another fellow from Cominco by the name of Charles Wright. We would like to have a meeting with perhaps four of your principal people."

So I went in and talked to Mr. Coyne to see which people should come for Stuart. Could they be made available for that particular appointment?

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Jensen: There were four people on the part of Stuart Oxygen Company: myself, Henry Eddy, Mr. Pat Coyne, president of the company, and Mac McKoon, who was the overall manager of plants for the company, but also a person who had done a lot of development work in the

heavy water end of the business. He was very well acquainted with it, a fine engineer with a strong operating background.

Dr. Thiele immediately started in quizzing us about this heavy water, asking constructive questions which we were not about to answer.

Swent: Not even to him.

Jensen: No. Particularly not to him because we weren't just too sure what he was going to do. We declined to answer these unless he told us what he was going to do with this heavy water. Of course, he in turn declined rather firmly to answer that question. So there we sat at a stalemate for some little time. Finally, my assistant, Henry Eddy, couldn't stand it any longer and he said to Dr. Thiele, "Doc, are you going to build an atom bomb?"

I thought Thiele would die. He wouldn't say one way or another but it was obvious just looking at him that Hank had touched on a very sore point.

Whether or not the other three members of his group knew--well, two I know positively didn't know. That was because Ernie and I were friends. Dr. Barr may well have known. Dr. Thiele said, "This is an extremely confidential thing. You must never speak of it to anyone. Word of this must never even go outside of this room." After considerable more discussion, Mr. Coyne then decided that he would allow us then to give the information on the design and operation of the plant to those people.

Dr. Thiele had a drawing of a plant they were proposing to build, to use in conjunction with the electrolytic hydrogenation operation at Trail, British Columbia. He said, "Well, I would like you to take a look at this particular idea that we have here."

I said, "I'll be happy to. I would like to take it home with me and then tomorrow, when we meet again, I will give you my comments on it."

I looked it over. I hardly had the heart to tell him it was about the worst design I had ever seen. When I came back, I just said, "Dr. Thiele, I feel that this plant might not be applicable for the purpose that you intended," and pointed out several places in it where I felt that it might not work. "However, I have prepared for you a drawing for the plant that you are considering." I pulled out a drawing made far in advance of the meeting on which the original estimate was based.

He said, "We'll go back to our hotel and study this and tomorrow we'll be back and we'll tell you what we think." The next day--. I would have given a thousand dollars if my professor of chemical engineering could have heard this because he thought Dr. Thiele was a god of the industry, if he could have heard him say, "Jim, you're right. We're going to do it your way."

Swent: Wonderful.

Jensen: I was just absolutely thrilled, as was Hank and others there, because although I perhaps try to take a lot of credit for this, there were other people who participated very fully in it. If it weren't for them, I'm sure it wouldn't have been so successful.

Swent: This was the plant that they built then in Trail.

Jensen: That was the plant that was built in Trail, modified with an ion exchange feed system. Although heavy water originally started out as one of the moderators for the atom bomb, there was also a concurrent program going on with carbon as a moderator. A company that I worked for in later years, Great Lakes Carbon, was in on a portion of that, making extremely pure carbon as a moderator. Actually, as I recall, I was told that the two atom bombs that were exploded over Japan didn't use heavy water; they actually used the carbon moderator.

However, in Canada, the Canadian CANDU nuclear power plants still use heavy water, but it is not made by that electrolytic process any longer. They have a better and more efficient means of making the water.

Swent: You were making it by an electrolytic process?

Jensen: Yes, we had an electrolytic plant. The reason that the heavy water plant was located in Trail, British Columbia, was that that was the largest electrolytic plant in North America. It was a very, very large operation. The plant was built, and it worked. When you're in a large plant like that, for example, there were certain systems of handling the feed material which we couldn't do effectively in our small plant but they could do there, which improved the efficiency considerably.

Swent: Where was your plant here in San Francisco?

Jensen: It was at 211 Bay Street, then a semi-industrial part of town. Simmons Mattress and Spring Company was right across the street. They had furnaces and rolling operations in their plant, making up light steel shapes, bedsprings, and materials used in that

industry. There were lots of other little chemical and mechanical industries which is all now built up in residences.

Swent: Did you need a special source of power?

Jensen: We just used the PG&E [Pacific Gas and Electric] power converted to direct current by motor generator sets. In this electrolytic plant we made hydrogen which was sold to companies producing hydrogenated oils here in the Bay Area. Oxygen, as a by-product joined that made by air liquefaction.

I recall there was a problem with very pure oxygen for the vacuum tube industry. I said, "Well, it's pretty easy to clean up the gas." I made them a little unit up with platinum black on silica so that when you pass a gas like hydrogen through it, any trace of oxygen is catalytically converted to water and removed by a drying agent. It works just exactly like the unit on your car that takes care of the materials that they don't want to contaminate the air. In effect, it combines the oxygen--which those people who were making these vacuum tubes couldn't stand--because if you had the slightest trace of oxidizing of the elements in there, the vacuum tubes wouldn't perform in the manner in which they were supposed to. It worked well, but we preferred others get into the business with making them. The system was also used in making pure deuterium.

Hydrogen is used for making things like margarines and products like that of hydrogenated oils. Later, they were able to make it relatively pure from petroleum based sources, or certainly pure enough for food oil purposes very cheaply, by using petroleum products, so the electrolytic hydrogenation plants for that purpose fell by the wayside. The labels on today's food products specify hydrogenated or partially hydrogenated oils.

Swent: Did you need anything special in the way of raw materials?

Jensen: Yes.

Swent: What did you start with?

Jensen: We started with the solutions out of the commercial hydrogen cells. When the hydrogen cells just ran by themselves, making hydrogen for commercial uses, we could get the heavy water in those cells up to about .04 percent. Then, by taking those cells and draining them and advancing them to other cells, we could keep improving the grade until we ended up with a very small cell that would make a 99.7 percent--or thereabouts--heavy water. Those cells were all made of nickel, or nickel-clad, one or the other. After the war started, it was extremely difficult to get nickel

because it was a strategic material. It went into cupronickel bullets with lead cores for rifles, as well as a host of other applications such as stainless steels and special alloys.

Early Hints of Cold Fusion

Jensen: The cell for making deuterium gas was made of platinum. I was always interested in those days in whether or not, in running this material down, we might be able to end up with traces of tritium. I saved all the residues from the deuterium cell over a long period of time to run it down and see if I could find the tritium. However, the cyclotron activities got so desperate for heavy water that I took my residues, worked them up and gave them to them and very stupidly did not ask them to check it for tritium. To this day, I have regretted that very, very much because here, a few years ago, these fellows over in Salt Lake found that by electrolyzing heavy water in a palladium cell (that is one of the relatives of platinum), they could get more energy out of the system than they were putting into it. They refer to this phenomenon as cold fusion.

This is a very, very controversial subject. You will find some physicists who absolutely swear it can't be done. You will find others who are equally as sure that it can be. I've often thought, here I was, doing exactly the same thing, except that it was all platinum. Although tritium would be one of the byproducts of it, of cold fusion, some say, there would have been no way for us to measure the small heat quantities that they had reported for their cells. I have often worried about their ability to do it too. That is extremely difficult as in the small cells the heat can readily be lost or supplemented by radiation and accuracy is difficult to attain.

But if you can get something that indicates that there has been a nuclear reaction there, then you may have an answer. Now, some of these people claim they have and other people claim that it is purely hearsay, so to speak. But I would like very much to know if the thing does work. Looking back at it, I thought I may have missed the boat on that particular one. Fifty years too soon I guess. I save all the information on cold fusion, keep track of it, and send it to my friends for their comments.

In the fall of 1991, I went up to Trail and we had a reunion with some of the people who worked on the plant fifty years ago.

Swent: It must have been very exciting.

Jensen: It was fun. I'm telling you we had a really wonderful time. Ernie Mason, who is ninety-six years old, still wanted to go skiing as he did when he was ninety-five. But I think the success of the plant that was built up there was due very, very much to his efforts. He was an outstanding design person, very knowledgeable and very practical. He has on the wall at home plaques from the then-U.S. War Department and the OSRD commending him on his contributions to the successful plant effort.

Swent: Did you work up there then also?

Jensen: No, I went into military service, but Henry Eddy kept in touch and the Stuart Oxygen Company was a distributor for the product in the U.S. The price dropped from about $2.00-$2.50 per gram to twenty-five cents per gram, but the distribution was closely controlled by the government. There was only one fifty-gram sample left from the early days uncontrolled.

V WORLD WAR II: ARMY COAST AND ANTI-AIRCRAFT ARTILLERY, 1942-1946

Jensen: Ernie told about his big arguments he used to have with Dr. Thiele, but I'm sure in most of those arguments that Ernie was right. It was one of those things that you look back at with a kind of pride. However, the plant no longer operates because, as I say, there are much more efficient ways of making the material now. So that is pretty much the story of it.

I have turned out an early history story which I had given the people in Trail and also all the people who were in the company, or we had worked together, or remembered it. Anybody I could find, I sent them copies of it, as well as to the University of California Bancroft Library and the Chemical Engineering Department of the University of Washington.

Swent: The article about your reunion, you mean?

Jensen: Yes, the reunion and also the original article that I wrote up which gave the history of the place. Hank Eddy worked with me on it too.

Swent: That was in the chemical engineering magazine, wasn't it? For publication?

Jensen: No, we never did publish it. We had hoped to, and this fellow, Billy Androsoff in Rossland near Trail, was hoping that he could perhaps find somebody who would publish it. I said, "Fine, if you can, please be our guest and go ahead and do so." So far, nothing has come of it as yet. In looking back at it, this was quite an interesting thing. Sometimes a person might say with respect to what action was taken, perhaps I should have made a point of not going into the military service and just stayed in this business all the time.

But here you find yourself in an extremely difficult position because I was brought up around that Old Army. These people took care of each other. I could have never faced it if I had left.

So that was the thing that got into my thinking, was a part of my thinking at that time. I could have stayed, I'm sure. I could have worked it, connived it, or however, and stayed in this country.

Swent: You could have gotten a deferment.

Jensen: Yes, but to have done so; no way. So I then went into the military as a first lieutenant and as I originally belonged to the old Coast Artillery which had the old forts up and down the coast defending all the harbors. The Coast Artillery never fired a shot in anger so far as I know; however, the Coast Artillery was responsible for anti-aircraft fire which of course later became a major item in their activities. I went from Coast Artillery over into Anti-Aircraft and followed that through until they finally ended up calling it artillery and guided missiles.

I managed by taking the proper courses and being in the right place at the right time and going to general staff school to receive a commission as a colonel and retired at that rank.

Swent: Where did you serve?

Jensen: In the United States, I started out there at the Presidio, and then at Camp Callen by San Diego. Then to Fort Bliss in Texas, and a little stint in the chemical warfare school in Edgewood Arsenal in Maryland, where I ran into many of my chemical engineering associates who were teaching the courses, professors and such. I learned a lot about both the chemical and biological warfare business. It was very interesting, but a bit frightening.

But, I always had these thoughts, that we would never see a real all-out chemical war. And the other thing you would never see--I have made this point for many, many years--you will never see a nuclear war.

Swent: I hope you're right.

Jensen: Oh yes. You're bound to be right, and there is a reason for it. The reason is this. If you got into a full scale chemical situation, you could probably make enough gas over here at the Richmond Refinery to kill everybody in the world practically. When you did, where would the market go? It's gone. By the same token, as I used to tell folks in the atomic energy business regarding nuclear wars, "Think about it for a minute. One big bang and everything is gone. Who is going to sell the pants and the shirts and the shoes and the cupronickel bullets with a lead core? That market is gone. It isn't going to be here anymore, as are many of the people who are in it. Therefore, you will never

see such a war." Of course, admittedly some kook or crazy person might explode one and do considerable damage, but I mean as far as a calculated one, I don't believe we will ever see such. I have been making this point for close to fifty years now, and it appears the current disarmament treaties recognize that fact so we can concentrate on more conventional wars.

I belonged to a group called SAME [Senior Associated Metallurgical Engineers] which Pete Fowler really started and was a member of.[1] We used to meet at the Engineers Club in San Francisco, a group of us who were in the mining and metallurgical business. There was a great to-do of discussions when the Russians and the United States started in saying, "Well, we're going to get rid of the nuclear weapons." Someone made the point, "Well, that's really lucky."

I said, "Well, it's lucky in a sense. There never really was a chance that such would occur. But the fact that they are agreeing on this now means that their next logical step is to have conventional war assured from here on out. Not nuclear wars; conventional wars. If you are in the metal business, this is wonderful. Watch and see what happens to the price of the strategic metals: copper, lead, zinc, and various others. Take a look at your market right now and watch and see what is going to happen in a few days."

I went down to Los Angeles and while I was there, one of the principal people in Washington, Weinberger, came in with a front page statement to the press. He said, "We must now arm for a conventional war." Then I got the quotations on the metals. Copper jumped from sixty cents or so to a dollar, as did other strategic metals. It affected the market all right, and I prepared Xerox copies of the supporting data for distribution to SAME.

People are aware of where and what is involved. Actually, I can't really complain too much about the nuclear business in that it provided interesting opportunities because I worked in the design and building of uranium plants. For many years it was a good business.

Swent: What sort of chemical warfare were they talking about?

Jensen: All types.

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[1]Hedley S. Fowler, Mining Engineer in the Americas, India, Africa, 1933-1983, Western Mining in the Twentieth Century series, Regional Oral History Office, University of California, Berkeley, 1992.

Swent: Were you working on that at all when you were there?

Jensen: Only in the sense of the training. In other words, to combat it. We had to wear these terrible suits that keep you from getting these blister-type gasses. I remember we were marching down a road one time, in the woods out there, and this airplane came roaring overhead and it just dumped gallons and gallons of tear gas on us, soaking our clothes. I'm telling you, it was a good object lesson. We didn't even expect the plane was coming. In a combat situation with lethal agents, if we hadn't had the proper preparation, he could have wiped us right out.

I recall that they showed a new movie of the casualties in the plants, making some of these things. It was so awful that so many of these officers--now, mind you, they were grown men--fainted and they had to discontinue it. They couldn't show any more of it because some of those things were gruesome. They were awful to see.

Swent: These were documentaries of what had actually happened?

Jensen: They were shown by the Chemical Warfare School mainly of casualties in manufacturing accidents. It gave you a good appreciation for possibilities. For example, when you went in there, what they did is they took a mustard gas and lightly touched it on your arm. The next day you would have a blister that would stand up about this high. It was the size of a nickel to the size of a quarter or larger.

Swent: Just from a drop.

Jensen: Just from touching it. So it was something, as I say, very fearsome, so to speak.

Swent: Did you go overseas then at all?

Jensen: Oh, yes. After I had been through these courses, I went down and had what they call a battery, a headquarters battery, and an organization, the 491st Battalion. I left that to join the 13th AAA Group and went overseas with them. The 491st went to Europe and I will be going to another one of their reunions here in September because I had many good friends in it. They had the distinction of shooting down one of the first V-1 type of rockets that the Germans sent over. They were never able to do anything with the V-2 because that was a true ballistic missile. It was not possible for them, or anyone else, to shoot those down at that time.

The 13th Group was a group that had several anti-aircraft groups under its control. We started out down in Espiritu Santo. That's the place where Michener wrote his book on the South Pacific. Then we were up at Guadalcanal, the Russell Islands and Green Island, way on the far end of the Solomons, New Guinea, and then up to the Philippines. The war ended when we were in the Philippines. We had our share of a little bit of excitement. But we were all very fortunate. Everybody came back okay and we had very little trouble.

Swent: You were in the Philippines when the atomic bomb was dropped then?

Jensen: Yes. I got such a kick from some of the fellows in the outfit because the navy wanted a piece of ground that we had. They said, "You guys have got to move off of there." I told these fellows, "Gee whiz, that's a heck of a note. This war is going to be over in just a very short time. I sure would hate to have to move for no apparent reason." Boom! The atom bomb came down. I had no idea of when it was going to be dropped. I was speculating. Some of the fellows came by and said, "You knew that thing was going to be dropped, didn't you?"

I said, no, I didn't, but I knew there was a possibility of such a thing happening but it was just fortuitous guessing that resulted in my saying that. They still thought I knew, or had some inside source, which was certainly not the case. So I returned from over there back to stateside here and I was asked if I wanted to join the Regular Army, but I did not wish to do that because I could remember talk of the old World War I days. When everybody got back, you might belong to the Regular Army but unless you were of the group of officers that came from what we called the trade school, your future there was very insecure.

Swent: The trade school being the Academy?

Jensen: That's right. Now, I'm not being disparaging about the people from the Academy. I think they are wonderful and I very much admire them. They have certain things that I feel that if we had more of in our life, it would be much less complicated. They have a code of honor--I will not lie, cheat, nor steal, or tolerate those who do.

There were some politicians here some years ago attempting to get that code of honor rescinded at the military academies, saying that this violated the civil rights of those people who wanted to steal. I talked to my old commanding officer who died not too long ago here at the age of 100, and he was a graduate of West Point in the class of 1912. I said, "I'm very concerned about

this attempt for politicians to get in there and attempt to do this."

He said, "I never had any trouble living under that code."

"Well, people who are honest and ethical wouldn't, but there are a lot of people who aren't. They are afraid of those who will not put up with their activities."

The other thing too, I came from this old army tradition where you took care of your troops. You made sure that they were well trained to the best of your ability. It is something that I have carried on in all of my other work. I elected to go into the Reserves. The Reserves at that time were a patriotic standby force. I stayed in the Reserves but I carried these leadership messages on to people who worked for me in the engineering business. In other words, to help take care of the people next to you.

This was the method, too, that Standard Oil used. When you came there, green out of school, they made every effort to make sure you learned and knew everything possible to be known, you might say, at that time, about the engineering business. This included night courses put on at the University of California.

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Jensen: I've had people say to me, "Why do you tell people who work for you everything? They'll get your job."

I say, they can have it. I'll get another one. But far better that they know, then I am not going to be embarrassed by something not working properly at some later date.

Swent: When you went back after the war, did you go back to Stuart?

Jensen: Oh, yes. When I came back from overseas, I went back to Stuart Oxygen.

At that time, of course, the heavy water plant was then gone and the price of heavy water had dropped from about two dollars a gram down to about twenty-five cents. But they acted as distributors for a long time in the United States. The company is long gone now.

VI PACIFIC CARBIDE AND ALLOYS COMPANY, 1946-1950

Building an Acetylene Chemical Plant

Jensen: I then went up to the Northwest because they were going to build an acetylene chemical plant there to make acetic acid using acetylene as a basis for it. I was in on the design work, the construction, and to some extent the operation of that plant. But while we were in the design phase, I mentioned to my old professor in chemical engineering that we were working on this. He said, "Be careful. Although the process you have comes from Germany, and is pretty well known, it is probably going to be superseded by the use of natural gas or petroleum products in this country. You won't be able to compete."

So I went in and pointed this out to the management. They called in some consultants who said, "No way." We built the plant. I practically could never forget. We no sooner had opened the doors than a fellow came up from Texas and offered acetic acid up there in the Northwest for less than the price of the acetylene that we had in it. The door of the plant was closed.

Swent: From petroleum.

Jensen: It came primarily from a natural gas and ethylene from petroleum. But the carbide plant was not completely dependent upon chemical use of acetylene. We made calcium carbide which was sold to the people who generated the acetylene for, in some cases, other chemicals, for cutting and welding, a limited amount of miners lamps (little used in the mines), and so on. I worked for that company for several years.

At that time, I developed a system for using petroleum briquettes from the Portland gasworks. Again, a point of pride because our principal competitor, Union Carbide, tried it and couldn't make them work. On the other hand, when I worked in the gasworks when I was in school, I made, by hand, the first

briquette of that type that the Seattle gas plant ever made. I had a pretty fair idea of how those things worked.

Gosh, we later bought Portland Gas's entire coke pile--thousands and thousands of tons of petroleum coke for something like two dollars a ton where we were paying twenty outside. We had probably the most economical plant in the whole United States.

Swent: Excuse me, thousands of tons of what? Of petroleum--?

Jensen: It was truly a lamp-black type of by-product.

Then we put out the word through the industry that we would analyze anybody's limestone sample for free and tell them what it was useful for if they would just bring in the sample to us, assuring us that it cut across the bedding planes so it was representative of the deposit. We didn't have to know where the deposit was unless the person controlled it completely. In other words, we weren't out taking somebody's property away from them.

I ended up with a book nearly two inches thick with every limestone deposit in Northern California, Oregon, parts of Idaho, Southern British Columbia, and even up in Alaska. We ended up through that finding a source of limestone in Enterprise, Oregon, which the company acquired.

Starting an Independent Mining Company

Swent: Which company was this?

Jensen: We called it Misander Brothers. Pacific Carbide and Alloys Company didn't want to get into the mining business. So I said, "Well, I'll get in the mining business if you don't mind my doing so."

The company said, "No, go ahead." So the four Misander brothers and I did the mining, crushing, pressing, grinding, and shipping.

Swent: What made you think of starting this limestone analysis business?

Jensen: Because in the making of calcium carbide, there must be an extremely small amount of phosphorous in the rock. In that whole country out there, you could practically count on the fingers of your hand out of the thousands of deposits, those that will meet this grade. It is extremely difficult to find. We found this

enormous deposit. I remember Mr. Coyne went up and I said, "Mr. Coyne, I think we ought to buy this place."

He said, "Well, Jim, how much rock is here?"

"Well, Pat, I will tell you. The deposit is about three or four hundred feet thick. I have walked the length of the thing practically and I don't know that I even got to the end of it and it is several miles. We go over on the other side of the mountain and it comes right through the mountain and out on the other side. I would say there is probably enough to last us for the next 10,000 years, and without even drilling it."

The fellow who had it went broke, and the company bought it through the Small Business Administration and paid $30,000 for it, which seemed like a steal because we got all the 200-300 acres of rock claims, which were patented claims, not right of discovery, regular patented claims, and about 200 acres or so of timber which I think the original people took claim on so they could use it to fire the old original stack type lime kilns that were there. It had a sixty-nine-acre farm with a house and buildings on it and a lime plant which had three big kilns on it, which we never used because we had our own which had been built in Portland. A spur track that was a half mile long provided shipping to Portland on a five-car freight rate.

Of the $30,000, we only had to pay $3,000 down. The balance was paid off at twenty-five cents a ton as we took the rock out.

Swent: Good deal.

Jensen: You talk about stealing. It was quite a good operation. However, as years went by, the lime operation up in Dall Island, Alaska, and places like that, which were on tide water, could ship by barge, and were very large operations, were able to put limestone by barge into Portland, and I mean good stone. My goodness, cheaper than just what we had to pay for rail freight from eastern Oregon. So the plant was discontinued. The company kept the property and finally sold parts of it. But they have kept much of the property.

Swent: So you finally got into mining a little bit.

Jensen: Oh yes. There was nobody else to do it, was what it amounted to. I suppose we could have found somebody but being in the plant where we used it and having control over our source and all was important to us. The carbide company had no money invested in it, other than the property and we had a very good agreement with them about price and delivery.

It worked out extremely well. This was a very black limestone. What it had in it, we had about 2 percent free carbon so that meant for every ton that we burned to make lime, it was like getting a gallon of oil. And it burned beautifully. It was actually a very excellent material. I've been trying to get a friend of mine whose wife does carving of big statues, and she always wanted black lime rock. I said, "Go up there. There are a million tons if you want it. And I'm sure the boys will let you have it if you want it."

In addition to the mining there were opportunities to visit many operations in the Northwest and consider getting into an anthracite coal project, and to study chromium, manganese, and silicon for ferro alloy products.

It was a very interesting job and you got to meet a lot of people and do a lot of things you normally don't get to do in the business. I've often kind of felt that a lot of the people who graduated from school and sat at the desk for all their lives just missed a lot of living, as it were. But then, while I was working there, the professor of chemical engineering came down from the University of Washington--he and I were great friends. He said, "How much money are you making here?" I told him. He said, "Get out of here. There are far more opportunities outside of here."

"Well, I like these wonderful people I'm working for."

"That's great, but you better look at your long-range planning. This job could be a dead end and it is just never, perhaps, going to be up to your full ability to succeed."

So I kept on looking around kind of casually. Then Sam Martin, who was the vice president of the Portland gasworks, went back and became the vice president of Great Lakes Carbon Company. He got me on the phone and since he knew that I had worked up at that lamp-black development and made it successful, he offered me a job at far, far more than I was making, except it had a tremendous disadvantage of having to go back to Chicago. This, I wasn't too happy about.

VII GREAT LAKES CARBON COMPANY, 1950-1953

Planning a Calcium Carbide Plant

Jensen: I went back to Chicago and spent some time there, but I didn't move my family back right away. I wanted to take a good, hard look at the situation. Sam was also interested in calcium carbide because the company had a large acreage of ground in Grand Rivers, Kentucky, near one of the dams down there. They had a 50,000-kilowatt block of power at 3 mils, an extremely low cost because they were close to the dam. He had the idea that he would like to get into some type of a carbide or other business of that sort. So he said, "Well, make me a report, please, on calcium carbide and acetylene."

"Fine. If we want to get into the business, to be economic, we have to make 100,000 tons a year. I don't think we should start with any less."

"Whatever you say."

I went up and made up this report and they looked at it perfunctorily. Didn't pay much attention to it. I thought, well, nothing will happen there, I guess. The next thing that happened, Sam happened to be on an airplane, and he was sitting by one of the people from Shawinigan Chemical Company of Canada, one of the world's biggest producers of calcium carbide and lime. They were interested in coming to the United States in a diversification of their efforts. Their principal efforts were in Three Rivers, Quebec, and Varennes, Quebec.

Sam said to him, "Well, one of our people prepared a report on calcium carbide. We have this power contract and strategic Kentucky property. If you would like to get into a joint venture with us, we would be happy to consider. Let me send you this

report. I don't know that it amounts to much, but in any event, you can see what you think."

Bang! Back comes a call from Montreal. The people in Montreal wanted to talk to somebody from the company. Sam said, "Well, I guess they want to talk with us. Why don't we go up there?"

"Sure."

So he, being the vice president, could speak for the company, and I being one of the engineers--. Then we had a fellow, Leo Danzker, who was very good at acetylene chemicals. When we ended up in the Shawinigan office in Montreal, we were sorted out. Sam disappeared. I assumed that he probably went to talk to the president and other principal people in the company. Leo was taken some place else. I figured he was probably going down to talk to the chemical people. But I was put in the board room. Gee, what a room! Twice as big as this [indicates interview location]. Great, big mahogany tables, just very, very plush.

I was sitting there thinking, my goodness, this is amazing. Who walks in but the president and several of his people; they introduced themselves. "Happy to meet you. We felt we had to talk to you."

"Oh? How's that?"

"You prepared this report we see right here?"

"Oh yes. Did you find something wrong with it?"

"No. On the contrary, it's given us a lot of concern. In fact, very, very much concern."

"How's that?"

"Who do you know in our company?"

"Gentlemen, other than you, I don't know a soul in your company."

"Have you ever been in correspondence with anybody in our company?"

"If I don't know anybody in the company, how could I? No, I have never been in correspondence with anybody, but what is your difficulty?"

"We had just priced and gone through the engineering on a plant we were going to put over in Varennes, Quebec. It is a proposed 100,000-ton-a-year operation. You have our capital cost right down practically perfectly. We figured that might be an accident, but you've got our costs of manufacturing down to less than a nickel a ton in all of our end of the business. We had to talk to you." [laughter]

Swent: They thought you had a spy.

Jensen: I said, "Well, gentlemen, I'm just not a neophyte in this business. I worked in a carbide plant for years. I know every aspect and cost. We made the best carbide in the United States, bar none." This was easy for me. You see, in order to make grade, United States government specifications calls for 4.5 cubic feet to the pound as the legal minimum. Anything above that, you're okay. But because I had this cheap coke, I could put extra coke into the furnace and what that did was drive the gas yield up. In other words, you got more acetylene gas out of a pound by far than was required by the regulations. I would run it up around 4.75 to 4.80 cubic feet of gas per pound.

The other competitive companies didn't like to do that because coke cost them a lot of money. They were leaning over on the lime side because lime was generally cheaper for them. So that kind of amused me a bit.

The other thing I told them was we had an efficient operation making this good carbide. Consequently I knew the details of it. I said, "This was strictly it." They sent us up to Three Rivers, Quebec, and we went down through their enormous plant. Fantastic! Lime kilns just all over, operating.

I went with this fellow, Andy Anderson, their engineer, who was always needling me a bit. We looked at the lime that was coming out of one of those big kilns. I said, "Andy, how come you let the kilns run to core?"

He said, "What do you mean, the kilns running to core?"

"There is a little piece of rock in each one of those pieces of lime that is coming out of there. In our plant, I would never let that happen because that rock would produce CO_2 and it would beat our electrodes to pieces. So we never let it run to core."

"You're crazy."

"I don't think so."

We walked over. I picked up a piece and it was hot. I knew we had him right then and there because the specific heat of limestone is higher than the specific heat of lime. The coolers are designed to cool lime. But if you throw a rock in them, rock comes out hot. He must have broken about fifty pieces. Every one had a piece of rock. He said, "How could you tell?" And this was at a considerable distance.

I didn't tell him, but when I worked in a lime plant, and I mean a plant where we burned great big chunks of rock, I must have broken a thousand pieces with a hammer because the operator would say, "That's got a piece of core in it."

"How do you know?"

"I can tell by looking at it."

"What do you look for?"

"I don't know what you look for, but it's got it." You would pop it and you would look at it. Sure enough, it might only be a little piece in the center. Eventually you developed a knack for recognizing it. By doing it enough times, you get to the point where you just simply looked at it and you said, that's it!

He [Andy Anderson] was a little bit distressed, so we walked up to this enormous carbide furnace, 25,000 kilowatts with a big stream of calcium carbide pouring out, and that's at 2,000 degrees Centigrade. That is white, white heat. I said, "Andy, how do you get away with making carbide like that? Do you use it all yourself?" Because they did use a lot of their own in their chemical plants.

He said, "What do you mean?"

"Look, that stream only runs at no more than 4.2 cubic feet of gas to the pound. Where I come from, we would never, never make something like that."

"You've got to be crazy again."

"Nope. I don't think so."

He called one of the operators over and he put a steel bar in the stream, as we used to do. We pulled out a little sample which would congeal on a steel bar. They ran it and it was 4.16. After that, he stopped giving me a bad time because, just by sight, he figured here was somebody who must know the business.

Yet, this is peculiar to many industries. I was around the lead business quite a lot. These fellows could look at some of these lead pots and tell you just what they had. I couldn't do it because I wasn't around it enough. In the paper business, these people could blow down a valve and sniff it and say, "Give it another ten minutes and the paper will come out exactly right from the cooker." And they would be right. What was that sniff? I don't know. I never mastered that one. But the ones that you do get into, you can really make it pay off.

We did a lot of work with Shawinigan, but unfortunately, they decided that they would not expand into the U.S. But it was a very, very interesting job. The company I was with, Great Lakes Carbon Company, also sold them electrodes which were used in their furnaces, so we kind of enjoyed a good feeling with the people there. Quebec Iron and Titanium was another, which I visited later. I also made a survey of wood sources for charcoal, but the market appeared iffy.

While at Great Lakes I was the manager of the 1000 TPD coal coke plant in St. Louis. Then, I went back to engineering and went out to the West Coast and worked there in diatomaceous earth, petroleum coke, and various other things that the company was interested in.

Swent: When you say you worked in diatomaceous earth, what were you doing?

Jensen: Primarily it was design work and much of it was involved with control of emissions. Breathing air with diatomaceous earth dust in it can cause silicosis. The California requirements are so stringent that one cannot see the maximum allowable dust loading. We designed scrubbers for off-gases of dryers, and bag houses for collection. All areas were vigorously monitored. Scrub water was impounded.

Swent: Designing the processing plant?

Jensen: Yes, from the process plans. We had several plants at that time. One was in Walteria which area is right now all built up in houses. It was a fantastic old property. Another was up at Lompoc, one in eastern Oregon, and one over in Basalt, Nevada. These and perlite plants were scattered all over. Earlier, before I joined the company, they had one in the state of Washington, but I never did see it. Major perlite source was Socorro, New Mexico, and these plants also made filter aids used in clarification in the wine and beer industries.

These were challenging jobs in an area in which one had to again use extreme caution with respect to the safety of the workers.

Swent: Silicosis was a hazard.

Jensen: Yes. We were fortunate in never having any problems with it, but we were also very, very careful, and always cautioned our users.

Swent: How did you avoid it?

Jensen: Oh. We would make aure we had filters and scrubbers and things like that. You see, the amount that is allowed legally, you cannot even see in the air. You don't even know it is there. We would have people who would count it all the time with so many counts per cubic foot. If it exceeded that, we made certain that we corrected the situation. This was true any place where we went that people were using it. We advised them to be extremely cautious, that anybody handling this stuff wears a mask, just don't get out and absorb that material or it would certainly give you health problems.

But Great Lakes was quite an organization. Again, the president of the company was a man I knew quite well. He was just an extremely fine man, George Skakel.

Mr. Skakel essentially owned the company. Essentially it was a very closely held company. We had at that time, I think, five corporate airplanes. Some of them were big airplanes, like DC-3s and a B-23. As a matter of fact, he had one that was rebuilt--it was an A-20--after the war. One of the sons in St. Louis, Rushton, a wonderful guy too, said, "Jim, let's go up to Chicago. I've got the A-20 company plane here and we're going on up there." So we went on up.

We got up there and I said, "Rushton, if it's all the same to you, I don't want to ever ride in that airplane again."

He said, "Why?"

"If you want to know the truth, I'm scared. I'm really scared. I'm very concerned about that airplane."

He laughed and thought nothing of it. You see, I had a commercial pilot's license. I have been around lots of airplanes that vibrated. As long as they were made of wood, I never worried about it because that old tree went back and forth for a thousand years and it never broke off. But metals aren't that way. They'll go back and forth for a while and pretty soon, boink. He

may have recalled that when that plane later blew up in midair over Oklahoma and both the pilots and his mother and father were killed. It was very sad because, as I say, he was a wonderful man and his wife was also a very lovely and wonderful person. It was most unfortunate.

Speaking along similar lines, I had one trip one time. It was one of the original Lockheed Electras. It flew out of Minneapolis to Chicago. I went in to our people who arranged transport and said, "Never put me on that airplane again, never on that type. I'm never going to get in one. You know, I felt lucky it made it to Chicago." They laughed and thought it was funny. After they killed 262 people, they found the wings were falling off of them. After they strengthened them, I flew in them and was quite happy with them. They also changed the engines on them. But before that time, it was just too scary for words.

Swent: You could sense that the vibration was excessive?

Jensen: Yes, it was excessive. I flew in a helicopter one time from Midway Airport to the O'Hare. Gee, that was another one. I wondered if it was going to make it to O'Hare. About two weeks later, he delivered all of them right into the cemetery. It vibrated excessively too. At least, it seemed to me that this was a very dangerous situation. It certainly was.

VIII ENGINEER FOR RALPH M. PARSONS ENGINEERING COMPANY, 1953-1955

[Interview 2: August 5, 1992] ##

Swent: In 1953-55 you worked for Parsons. Is that correct?

Jensen: Yes.

Swent: How did you get that job?

Jensen: The job with Ralph M. Parsons [Engineering Company] came as a result of the Great Lakes Carbon Company closing the engineering department in Los Angeles and asking that people return to Chicago. Only one, the assistant chief engineer, went back to Chicago. I saw an opportunity to go to work for Ralph M. Parsons working on a classified government project to produce diborane products which were high-energy fuels for the missile program. This plant was designed and a small plant built in Muskogee, Oklahoma for Mine Safety Appliances Company's Callery Chemical Company.

It did produce a fuel, except that they found that the product of the combustion of the diborane was boric oxide, a solid, rather than being like carbon dioxide, a gas, as in the case of carbon-based compounds. So it was difficult to build a piece of equipment which would effectively use this particular fuel. The project was eventually dropped, although the company itself did continue in the borax-based minerals and chemicals business, as Callery Chemical Company in Callery, Pennsylvania. Callery also produced NAK [sodium potassium] for use as a cooling medium in nuclear submarine propulsion engines.

Then I heard of this opportunity through a friend of mine to take a job with American Potash and Chemical Company. They were looking for a replacement for their chief engineer, Mr. Myron Colony, in Trona, California. I went up there and applied for the job and was fortunate in receiving that position.

IX AMERICAN POTASH AND CHEMICAL COMPANY, 1955-1957

Swent: Let me just ask you to be a little more specific. You said, "Through a friend of mine." How do these things come about?

Jensen: This is the way of the industry. Everybody used to sort of look out for each other. You know people, they get around, they find out what is happening in the industry. If they know that you have a need, they'll give you a call. I've done the same for many, many people and hired many under those circumstances, too. It was just a way of life at that time.

Swent: These are people that you had known from college?

Jensen: In some cases, yes. In some cases, you had worked with them or around them or you knew their background. In other words, you were pretty well assured that they could meet the requirements of the job. In deference to your own situation, you didn't want to make a recommendation for somebody and have him not work out. This would have been detrimental to your reputation.

In any event, as I say, I went up there to Trona, which is not too far from Death Valley. When I first looked the place over, I was sort of appalled because it is truly a terrific desert. I thought, "Oh, oh; is my wife going to approve of this?" But she went along with it.

They asked me if I wanted to take this particular job as sort of the assistant chief engineer. I said, "By no means do I want to take that job." They said, "Well, why don't you?"

"I come in here, to you people and to the members in the plant as a stranger. They don't know me. I am an outsider. They will resent me. Things could be very, very difficult. I prefer coming in with some type of innocuous title for a period of time until I get to know everybody in the plant to the best of my ability, certainly those that are working in the engineering end of the business. Following that, when it appears appropriate,

then we can go ahead and take the position of assistant chief engineer. When the chief engineer retires, which he was slated to do, then I can take over his job."

This worked out very, very well. As I say, all too frequently, you do find that this problem exists in plants. They have to get to know you and be certain that not only are you looking after their interests but they are able to look after your interests too. As I say, it did work out. I did become the manager of engineering. They dropped the title of chief engineer after Myron retired.

Swent: What sort of plant operation was it?

Jensen: This was a plant that through solution mining of the Searles Lake brines produced potash, soda ash, sodium sulfate--as they called it, salt cake--lithium, and a little bit of phosphoric acid as byproducts, and various borax chemicals. We made bromine as well.

This was an old time plant out at Owens Lake. My goodness, they had started there many, many years before. The secret to the plant, however, was the solution of the method of separating those dissolved chemicals, by a system called the phase rule. When this was mastered, the plant was very, very successful.

Swent: Did you have anything to do with that development?

Jensen: Essentially all the phase work had been done, although research specialists continued its study. The work that I was doing was associated more with the engineering in conjunction with the construction of additional plants, maintenance work, feasibility studies, and items of that general type. We had a-good sized engineering department, with registered professional engineers who were chemical, electrical, mechanical and civil. We signed all our own drawings. They were never looked at by the building department from the San Bernardino County who allowed us to do that. We never had any structural or other failures based on our own people handling it. It was a challenging job and an interesting job. It took a lot of time. You had to get to know the people and get down and convince them that you knew something about the business.

Swent: How many people were employed there?

Jensen: In the plant, between 900 and 1000.

Swent: Did it operate three shifts?

Jensen: Oh, yes. It was a three-shift operation every day of the year. And we turned out a trainload of products every day. We did not produce salt. We left the sodium chloride lying out on the lake where another contractor, who subcontracted to us, removed the salt and sold it for water-treating purposes in Los Angeles.

Swent: Sodium chloride.

Jensen: Sodium chloride. The system of drilling wells was very interesting. There were various levels of the lake which had concentrations of salts that varied to the point where it was better to go down to a certain level, for example, to pick up high sodium carbonate, if we wanted that one, or at another level, to pick up potassium chloride.

Swent: Were you involved in that?

Jensen: To some extent. But it was well known by the time that I arrived there. We did build several additions to the plant, all of which worked out very well. Of course, there was always the routine maintenance. There was a lot of very heavy equipment in there, tremendous machinery, tremendous compressors. The rotary kilns, thickeners, and all the things that are used in the normal mineral and metallurgical business.

Swent: What brand were these? Do you remember who made these?

Jensen: Oh, gosh. They were made by a number of different companies. Denver Equipment made some and even the old Western Machinery made some of them there. Some, amazingly enough, they had picked up second-hand at other plants. For some I have no idea what their background was, they were in-house fabrication.

Swent: Did you have a favorite?

Jensen: I frankly liked Denver Equipment.

Swent: Were you involved in the selection of the equipment?

Jensen: Yes, we got into the equipment selection, although these were joint decisions by the operators and engineering. The equipment selection was based on whether or not it would do the job, which should be the first thing. Then of course the price and delivery. I did see one situation where one of the men in the company convinced the manager that a certain piece of equipment would have been far better than that originally proposed and it was so much cheaper he couldn't resist it. At the time, I was away up in Stanford at business school. When I came back, I said, "This is going to be a disaster. This is going to be a lesson to

everybody. Not to me; I know what's going to happen." It didn't work. We had to replace it. It was a very distressing type of situation.

Swent: What was the problem with it? Why didn't it work?

Jensen: Why didn't it work? The reason it didn't work was because we were making a compacted potash which we called agra; it was used in fertilizers. This was put through rolls or pelleting machines. Then it was crushed. Now, material of that type has to be crushed very carefully so you put it between rolls and you just squeeze it and break it a little bit and then it will break into granules that screen easily. What this fellow recommended was a hammer mill. A hammer mill just beats everything to a dust. When it beats it to a dust--when what we were after was the compacted, small granules--we had a tremendous recirculating load, over 50 percent.

Then the milled product undersize went through a phenomenon which was called "tired potash" because the feed, once that had been compacted and broken down, would not readily recompact. So we were stuck with just what to do with the junk. You couldn't sell it for anything. You could recycle a certain amount of it but any more than 10 or 15 percent, then you were in trouble. So we had to redo that plant section. But that poor fellow later went up on the hill and left this world the hard way. It was a shame, too, because otherwise, he was very competent.

Then we did a lot of evaluation work for proposed plants. I recall one. They wanted to make a fused boric oxide. The head of the department said, "Design a one-ton-a-day plant up here, to replace the one we have operating down in Los Angeles which we would like to move up here so we can take advantage of the tax depletion on the feed materials." I looked at it and it didn't look too good so I ran it through my economic evaluation system. Although I hadn't been down to see the plant in Los Angeles, I came up with a figure. It was costing them twenty-five cents a pound to make a material that they were selling for seventeen cents.

So I went in to see the president. I said, "I feel that plant doesn't pay."

He said, "You mean, you just did that by figuring it out?"

"Yes, I did. But what I suggest you do is have the people in the Los Angeles office accounting department go down to the Vernon plant, go through it and count every single cost item that is in that boric oxide plant, everything, and see what they come up

with." I had 25 cents and they came up with 25.2. That sold them on the system that I had brought to the company, and also later to Western Knapp Engineering, of evaluating projects. It worked. You could get a proper answer. I had very good luck with it over the years.

They then sent me to the Stanford Business School Executive Development Program (a condensed business course for one summer). I think they felt I had a future with the company. However, I was beginning to become a little bit concerned about the company because they had what we call the "bean counters" go through and start indiscriminately laying people off. I recall that the one person that they laid off--and I went in and protested very strongly--was our bonded weighmaster. I said, "My goodness, bonded weighmasters are difficult to find and unusual people." Not only did they lay him off, his wife worked for me and so she quit and went to work for one of my old friends who was vice-president of Southern Pacific Railway in San Francisco.

This went down through the plant and the morale went way down. It was a difficult situation. Then there were other things regarding their accounting procedures that bothered me as far as the overall situation was concerned in the plant. The method used did not truly represent the worth of the company--it was a hollow shell, but effectively ran the stock price up. So I felt that I had better pick up and leave because you could see the handwriting on the wall.

I got out, as did the head of the research group, Dr. Donald Garrot. Every time I meet him now, we shake hands and congratulate each other that we got out before the axe fell because it did go way, way down, unfortunately, although it was a very wonderful company at one time. But by not watching what they had done, making acquisitions that apparently weren't well-studied out and doing things that adversely affected their return, the plant finally was sold to the Kerr-McGee Company and has again since been sold to another company.

Here again, the follow-up companies had problems because the old timers, who knew the business really well, were gone. To bring somebody in brand new just doesn't work well. They have had many problems, I'm told.

They had designed a new soda ash plant and I went to see one of the fellows that worked for me in the shops in Trona. He was telling me of some of the things they did because he was acting as a consultant.

I said, "How could you do that? You are doing things that we knew wouldn't work twenty-five years ago."

"Yes, I know. But the Kerr-McGee people are oil company people and they would say, 'You don't know what you are doing.' They wouldn't listen to it."

It didn't work. It took them pretty close to a year to start that plant.

I went out and saw the plant at U.S. Borax and Chemical in Boron, because the AIME [American Institute of Mining, Metallurgical, and Petroleum Engineers] had a trip through it. I came back and wrote a report on it. I said, "That plant will not start. It won't work for six months to a year. It was designed by some engineers who had never seen a plant like that. The people in it were never apparently consulted on it. Besides that, they didn't put enough money into the thickeners and I don't think they will make it."

But you're looking at a fellow who is not too smart when it comes to other things. I bought some stock in that company because I figured it would go right up. It did but before I could sell it in six months and make my money out of it, it was discovered the plant was no good and the stock fell from where I bought it at down to about half of what I bought it at. I finally sold it at a significant loss.

Swent: What year was this?

Jensen: That was 1956. They put in, for example, the thickeners. The mechanism used in the thickener looked like it had been designed by somebody who did spider webs. When they went around, they made about two turns and the whole thing just wrapped up. The other thing they didn't do in the borax plant: on a valve, you have a steamline before it, you have a steamline after it and you have a steamline into it. If you don't, you'll only open it or close it once. They didn't have that.

There was just a number of other things I noticed going through there. For example, they put the borax in great big tall concrete tanks. They practically blew the tanks down with dynamite to get it out. You just don't put borax into tanks like that. You'll never get it out. Yet those people were in business years and years before that. Why did they let somebody tell them? I don't know. But whoever told them that just had no awareness of the borax.

Once in a while, I used to get the manager up there at American Potash a little distressed. We would be going down through the plant there and have these great big steam engines that drove the ammonia compressors for refrigeration. I went up and put my finger on it and said, "Well, I'm afraid the rings are going to be out on this one in a week."

"How do you know?"

"Well, it's talking to me." In about a week, they would be gone. We had quite a session on that, I recall, because they said, "Well, what's the problem?"

"Well, your steam is too hot here. When you put these in, you didn't put a desuperheater on the steam to the engine. Therefore you are burning the oil out of it." You see, I was brought up in the steam engine school.

Finally, after a long period of time, when we were just fighting rings like mad, I said, "Well, if you are willing to spend the cost of a phone call to St. Louis, the exact same engines are sitting there in the Great Lakes Carbon plant in St. Louis and have been running for thirty years and no problems." They finally conceded that, well, they would give them a call.

So I got a hold of the fellow and I said, "Hey Bill, how's it going?"

He said, "Fine."

"How are the old engines running out there?"

"Great."

"You still making your own rings for those engines?"

"Yes."

"What are you making them out of now, Bill?"

"Just cast iron, like we used to."

Here we were buying super alloy rings and they were still going out. So I told him what the circumstances were and he said, "Steam's too hot. You're burning them up."

"Thanks very much. I think you're right. That's the answer to the question." We still got a lot of argument, but we put in the desuperheater and never had any more trouble. I've put them

in other places. I put them in down in Africa too. What it does, you see, when you reduce steam--these engines run at 250 pounds per square inch, and they are reducing the steam from 400 pounds, if you put that right through a valve and just let it blow down to 250, it becomes extremely hot, superheated. Well, for a steam turbine, that's great. But for an engine, they don't like that diet. Nor does a heat exchanger because the desuperheated steam acts just like air. It will not transmit that heat which comes as a result of condensation of the steam. So you put in a desuperheater to knock the temperature down. All it does, it gives you more steam. That was the nature of that particular material there. It was a very interesting and challenging job.

Swent: But you left it in time.

Jensen: Oh, I was lucky to get out of there.

URANIUM EXTRACTION PLANT - NEW MEXICO

WKE

Fourteen, aerated vessels for conversion of solids in carbonate solution. Operated at 190° Fahrenheit and 15 pounds per square inch (absolute) pressure. 22'-6" diameter by 60' high. Preheating of feed with steam in concentric tube heat exchangers. Vessel design by WKE. Over-all plant design and construction by WKE. Piping design permits taking any vessel off stream without shutting down plant.

WKE

X WESTERN KNAPP ENGINEERING COMPANY, 1957-1977

Swent: Then you went to Western Knapp.

Jensen: I went to Western Knapp. Western Knapp had done jobs for us in the Trona plant. All of them had worked very well. I was very much impressed with them.

Swent: Where was their headquarters at that time?

Jensen: In San Francisco. The other company that did a lot of works for us down there was Stearns Roger of Denver. They did good engineering jobs. The only thing, the only big problem, I had with Stearns Roger was they would give you an estimate of what they thought it would cost to do the job and then the job always cost twice as much. Unfortunately, to the Trona engineering department fell the responsibility of explaining how these overruns occurred, so the board of directors could be simmered down. They didn't like that type of thing.

But it happened time after time. Sometimes we would put in a factor knowing full well that they, hoping to get the job, would underprice it, feeling that they probably had a preferred position getting it; they led us along, you might say. Western Knapp didn't do that. The answers they gave were very close and the jobs they did were very satisfying. I looked around at several different companies; I wasn't too anxious to go back to Ralph M. Parsons. I liked it better up here in the Bay Area. So I had an opportunity to go with WKE and join the folks in their engineering department, working on uranium plants to start.

Swent: Did this get you into a brand new field?

Jensen: Yes, in a way it was, although going back to the original days of the heavy water, that related to the nuclear business and uranium although I didn't get into that phase of it at that time. The Western Knapp Engineering Company, during the time I was there, had built most of the uranium plants in the United States. We

built plants for Phillips Petroleum and Homestake-New Mexico Partners in Grants, New Mexico, a great number of other plants nationwide, and also modified a lot of plants. We built the first uranium plant for Dave Marcott of Cotter Corporation in Canyon City, Colorado, eighty days from a standing start. And they produced material which he was able to ship to meet the terms of timing of a government Atomic Energy Commission contract. Of course, after that Dave never looked around for another contractor. He was an old-time bomber pilot and old-time miner, and he would come in and say, "What are you all doing to earn an honest living or are you working for Western Knapp Engineering Company?"

"What do you need done, Dave?"

"I need another plant. When are you going to get started on it?" Sometimes the plant would be half done before we would get around to having a contract with him. You had a trust relationship there that was fantastic. It was like the old days. You weren't worried about having a bunch of lawyers look over your shoulder at everything you did. Up until the final plant we did for them, and I wasn't on that plant--I wished I had been--but I was sent over to see if we couldn't do something about the startup. Unfortunately, they put about the third team on it and they were just learning the business.

Swent: Where was that?

Jensen: That was also in Canyon City, about the third or fourth plant we did for him. I went back to the office and I said, "In view of our longtime relationship with Dave and all the jobs we've done for him, I would like to send one of our people over there for a month and get the mistakes straightened out that our people have made. They are serious. He needs help. I think in the long run it would certainly pay off to do so." They were very negative on that, and we never did get another job from Dave Marcott or Cotter Corporation. As a matter of fact, I used to tell the salespeople, "This bid being sent, you don't have to bother to send that over because Dave is just going to throw it in the ash can." I could go over and talk to him, had a very good relationship with him, very straight-forward and honest. But others in the company, he wouldn't talk to them.

Building Uranium Mills in New Mexico, 1957

Swent: Western Knapp built the Phillips Mill at Ambrosia Lake near Grants, New Mexico. Were you personally involved in that?

Jensen: Yes, that I was very close to it as a process engineer, instrumentation engineer, design, and startup.

Swent: That was a different kind of mill from the others, wasn't it?

Jensen: Let me put it this way. These mills varied. Some were acid leaches and some were carbonate leach. That particular mill was a carbonate leach.

Swent: And the Homestake-New Mexico Partners mill?

Jensen: That was carbonate leach. The two plants were quite similar.

Swent: Did you work on that one?

Jensen: No. We did a few little things on it but nothing very significant.

Swent: Then your big job in Ambrosia Lakes was with Phillips.

Jensen: Yes. Anaconda also had a plant down there, and we went in and did studies on it, but nothing really significant on the plant itself. The Phillips plant was designed for 1750 tons a day. It exceeded the design capacity and we came out within the budget. They were happy with our work. It worked out all right.

Swent: What was your role in that?

Jensen: It was a complex plant. The first role that I had was to try to straighten the company out with regard to the types of drawings that they made.

Swent: Who were you working with?

Jensen: I worked with people on both sides.

Swent: What were their names?

Jensen: Dr. Bob Kobel and Jim Nichols, and there were several others that came up from Oklahoma. The thing was that I lived in San Mateo, California, and the people from Phillips lived in the San Mateo Hillsdale apartments which are right at the foot of the hill. So we all rode to work in the same train, designed the plant every

morning, and tore it down every evening, as we jokingly said. Being from Standard Oil made it easy for me to talk to them. Ours was a great and understanding friendship that helped make the job go well.

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Jensen: The first big problem was that up until that time, most uranium plants used relatively simple flow sheets, what was called a block flow sheet. I said, "But we need a P & I [piping and instrument] diagram so we'll get our piping straight."

WKE management said, "Oh no. We don't make those things."

I said, "By golly, those things were used clear back to my days at Standard Oil Company many, many years ago. I don't know how we can do it effectively for a job of this complexity." So I complained to the Phillips people and said, "Look, if we don't go and get P & I's, we're in trouble. You people must use these in your engineering business."

The Phillips representatives said, "Yes. As a matter of fact, we don't know how you can do it without it."

"You know as well as I do that we can't."

"Your management people came to our management people and told them they don't need to make P & I diagrams. You just use simple blocks and reduce the price."

I said, "And they bought it?"

"Well, they put it to us in the engineering department like this. 'Maybe these people know something we don't. Let's see if we can find out whether or not it has merit to it.'"

It soon became evident that it just wouldn't work. Eventually, it ended up piping the plant just from the P & I diagrams rather than perform piping drawings, which is not a good way to do, but in order to get it done in time we had to do it that way. Every plant since has had P & I diagrams.

The other thing I brought to the company, that is, Western Knapp Engineering, was again, this system of evaluating plants. I had every uranium plant in the United States and its costs on a size-cost logarithmic diagram. That line is almost a straight line for any combination of plants. So you could very quickly look and see that your numbers were within reason. Then when you filled out the other forms which are on its operating costs, we could get them very accurately.

Swent: Where did you get this information on other plants?

Jensen: This is published information. You see, these are government plants and all of the costs of them were set out.

Swent: They were all AEC [Atomic Energy Commission] contracts?

Jensen: Yes. Sponsored in some way, or underwritten, you might say. The information was available. I felt very confident about the accuracy of it. I always felt that that helped us a lot in our discussions with clients and in the accomplishing of the job.

Swent: Was there any awareness at that time of radiation hazards; did you get involved in the safety issue?

Jensen: Yes. We had involvement in radiation. Primarily, one of the big problems was in the tailings ponds because you see, when you go through this particular method of taking out the uranium products you are looking for, you also leave some of them in the tailings. They report out in the pond and some of them are picked up in the water. So the ponds had to be very carefully sealed and little wells prepared outside of them to be sampled to be sure that any drainage was not radioactive or that hopefully there was no leakage in fact.

There were also problems with radon in underground mines, requiring adequate ventilation. Most plant areas were not too much of a problem; wearing of badges was required in many plants.

Swent: Was this imposed on you by a government agency at that time?

Jensen: At that time, yes, there was a lot of concern about it. Of course, a lot of companies before that time, like the one up in Lakeview, Oregon, just threw their tailings out in great big, sandy piles. When the wind came up, they were scattering it all over the country. I brought up a Geiger counter with me and very definitely it was radioactive. Later I picked up on my own a scintillator which I would use when I went into plants just to be sure I wasn't getting into something I didn't want to be into for too long a time.

It was a very sensitive and accurate piece of equipment. It had samples with which we could calibrate it.

Swent: You were doing this to protect yourself?

Jensen: And others. I know, for example, in one plant we did in Palabora, South Africa, we had a strongly radioactive lead constituent on

the tail end of it, you didn't want to be within several feet of it, so we put a fence around the place, with signs.

Swent: When was the Ambrosia Lake work?

Jensen: That was in 1957.

Swent: And Palabora?

Jensen: Nineteen sixty-nine. They landed on the moon when I was in Johannesburg. We had gone through a number of other plants.

The other thing, of course, as far as safety was concerned was just do the things that are normally safe to be done. Platforms, stairs, things like that the civil engineering people theoretically took care of. But you had to look at it and make sure that it was done so that it met the safety standards. I worked primarily as what we call a process engineer. The situation there was to be able to tell people in the design how it should be laid out so that it is easy to operate. In order to know that, you have to have operated plants because the main thing that most of the civil engineers were interested in was pouring a bunch of concrete, hopefully in the right place, and putting up a building that you would somehow squeeze the plant into. This is not the way to build them.

I hate to say this about my old company but I saw them put up a building where the manholes were six inches away from the wall and you had to take the building apart to get into them. That sort of a thing gives you a bad reputation if you are not careful.

Again, on a safety aspect, I did complain to the client that wanted to use the water out of the mine for potable and boiler water.

Swent: This is Phillips?

Jensen: Phillips. They finally got their own way, but we did treat it with a regular water-treating system. We were still very concerned about using that mine water for drinking purposes. There was no difficulty with using it for making up the solutions for recovering the uranium.

I know there have been problems in the Grants area. You hear complaining once in a while about uranium in the water, radioactivity in the water. Not up in San Mateo, New Mexico, however. The bar there had a dirt floor in it too. Let's see, the Spaniards came through there, when was it? About 1540 or

thereabouts? Because I know they left their names on the walls of the cliffs in the Zuni country.

Swent: El Morro. They were there very early, before Plymouth Rock.

Jensen: It was amazing. They were looking for gold but I guess they were disappointed in that there was no gold to be found up in that country, although they were walking over a lot of values they didn't realize in the form of uranium and probably, in some areas, oil.

Swent: Did you spend much time down there then?

Jensen: Oh, yes. I went down on the start-ups. I worked on the end of the phase of the construction and also the start-up. I always remember the fellow who was the field manager, an old-timer, Art Edson.

At any rate, he was very, very critical of a heat exchanger design we had come up with to interchange feed to the tanks. He says, "It won't work."

I said, "Easy, easy. Come on over here in this nice, quiet place."

He said, "Why? What's the matter?"

"You know it won't work and I know it won't work, but that piece of equipment doesn't know it won't work. If you don't tell it that, it will go ahead and just work like it is supposed to." And it did. We ended up, as a result of that and some other activities that we did there, getting the Chemical Engineering Achievement award for it, which I felt was kind of a high point. In fact, I have a copy of the thing here.

The plant ran well. Everybody was very happy with the plant. Not that we didn't have some problems. There were some things that we had to take care of that were, frankly, of our own doing. I remember one which rather amused me. They had these vacuum machines as big in diameter almost as this room, run by 600-800 horsepower motors. I had said, in the design phase, "What we must have on that big vacuum line is a bleed line ahead of it that we can open with a valve on it before we can start that machine."

They said, "Why?"

"This machine will never start under load."

"You must be crazy."

"No, I'm not. I know exactly whereof I speak." I didn't tell him that we had the same machines in American Potash. They sent it back to the manufacturer. He came back and said, "No, you do not need relief valves on the suction end of those machines." So I very carefully took this letter with me, a copy of it, and when we got down there, the fellow came out from Roots Connerville, the company that sold us the machines that he was supposed to start. The first thing he did, he looked at it. He said, "I can't start that machine."

"Why not?"

"You don't have a relief valve on it."

"You don't need one."

"Who are you to talk about it? You don't know anything about it."

"I know a little bit about it. I know you can't start it but I have a letter here from the head of your company that says you can. I want to see you start it, because if you do, I'm going to learn something, maybe."

He went over and slapped the switch in. The thing went, "Arrrumpf." Out went the breakers. He tried it again. "Arrrumpf." So he said, "There's no way." Eventually we had to go back and put valves in the thing. Sometimes, people become very, very difficult to convince of the need for something that is quite obvious. They just don't realize that there are some limitations.

Swent: So there is no standard design; each one is distinct?

Jensen: All the plants are different. Of course, in that sense, with a lot of companies we had a situation where we were building a plant to go back to the original drawings of other plants and use what you did before. Sometimes you repeated your mistakes because the drawings weren't always changed to reflect the changes of things that didn't work. I remember in a couple of places, they repeated mistakes. I came along and said, "Hey, this didn't work in such and such a plant."

"Where did you get this?"

"Well, it was in the drawings."

"Those drawings were never revised. You better change it so that it will work." But I did a lot of the instrumentation work.

I did the steam boilers, being one of the very few people who had been brought up around the steam school. It worked out well.

I always remember a story--I really probably shouldn't tell this on Phillips, but we started the plant and we had the four boilers roaring away. A fellow walked up to me and he said, "Say, what's that thing up there supposed to do?"

"Well, that's the desuperheater. That is a part essential to the feedwater system of the boiler. It operates at 5-8 psig. Are you the fireman here?"

"Why yes, I am."

"Have you ever worked in a steam plant before?"

"No, I've never seen one."

Fortunately, the Phillips Petroleum field man, Jim Nichols, was standing there right with me. I said, "How long have you worked for the Phillips Petroleum Company?"

He looked at his watch. "About forty-five minutes."

"Didn't anybody take you down here and tell you anything about it?"

"No. They just said, 'Go down and start running them.'"

I turned to the Phillips man and I said, "Jim, I think we had better at least make a one-hour fireman out of this man rather than go home and enjoy that steak dinner that is waiting for us, because if we don't, we aren't going to have a plant here in the morning." There were four boilers sitting there roaring away. You could well imagine what could happen. So the thing to do was to go through them and show him how to start them, how to stop them, how to be sure they had the water. We had to give him a little education. When we came back the next day, we still had a plant there.

But it could have been very serious. I think Jim was embarrassed by the fact. Phillips was normally a company that wouldn't do that, as they are like Standard Oil Company. At Standard Oil Company, I could never conceive of a situation like that happening. Every once in a while, some of these things do happen or slip through.

But these are just little incidents. I guess they occur in all the plants. I remember once they complained they couldn't get

the heating system in the lab or the cooling system/air conditioning system to work in the lab. They said, "Would you take a look?"

The only thing I noticed was that a great big duct came up to the wall and then on the other side of it it apparently went on. Nobody thought to cut a hole in the wall. It makes a big difference.

Swent: I would think so. [laughter]

Jensen: You get into some things like that that fortunately are easily remedied but you wonder how people can do them.

Swent: But the Phillips plant was a big success?

Jensen: It was. Yes, they were very happy with it. It was a plant, however, that they wanted designed and built to last only for five years, because that was the length of their contract. At the end of that time they were going to leave it. And they did. They made their money, they satisfied the government requirements, and they later sold the plant. They did get into other facets of uranium processing but they didn't do too much with it. I think their main interest was in oil. They probably did best there. Now, in the case of Standard Oil Company, later they got into the diversifications to include mining and minerals.

All the companies that I worked for at some time or other during their lives either had a staff of geologists and people associated with that end of the industry to look into possibilities for diversifying into minerals and metals or were using those minerals and metals in their own operations and were looking for other sources. There was a wide interest in it. Standard Oil Company looked into a geothermal plant down in the Salton Sea, California.

In recent years, Standard (now Chevron) went into a palladium development in Montana. I have been following that with much interest for the simple reason that the electrodes on the cold fusion, which use heavy water, are made of palladium. Whether or not this is going to come up as being the big thing in industry we don't know. It's very controversial as yet as to what the mechanism is that makes the excess energy. Hopefully, they will solve it, because if they do, it could be a boon to the United States economy as far as energy is concerned.

Back again to Western and overseas uranium, we did work on several plants. All of them worked out well. Of course, as the uranium business tapered off, many of them discontinued their

operations. As long as the government was buying the materials at a set price on which they could make a guaranteed profit, the business was attractive. Later, prices dropped to the point where many weren't able to compete. I know Phillips was getting somewhere around $12 a pound. In later years, I went down and saw International's uranium plant in Florida with their vice president, I. Milton Le Baron. They were making a uranium concentrate as a byproduct from the phosphate industry, but the plant was small, and its operations almost primitive.

He said, "Well, Jim, I'm going to drop the price on uranium to $5 a pound."

I said, "Uh-oh, Milton." Because you could tell by looking at that plant, he couldn't make it at that.

I said, "Are you prepared to go down there and maybe follow that down a little bit? If you aren't, all you are going to do is break the market." He decided to shut the plant down.

There has always been a lot of discussion about radioactivity in the rivers and streams in the country, particularly in areas that use phosphate fertilizer products in which there are significant amounts of uranium. When that is put on the farms in, say, the Middle West part of the country and leached out of the soil, it reports in the rivers. One hasn't heard too much about it in recent times but for a long time there was a lot of concern about it in the media.

Middle East Potash and Phosphate Studies, 1963

Jensen: I had the good fortune to do process and project engineering on two jobs in the Middle East. WKE had a contract for preliminary engineering and design to include preparation of bid data for a potash plant on the south end of the Dead Sea in Jordan. The final design and construction of the plant was done by another engineering company. I spent, oh, I guess it was close to a year out there off and on, and it was a very interesting job. The Dead Sea has always been an interesting place, as the Romans studied the area carefully.

While I was out there, we had a chance to bid on a job for which we did the preliminary engineering for phosphates in Syria, out by Palmyra, the ancient city of 4,000-5,000 years ago. We went out and looked at the deposit carefully on several occasions. Techno Export of Russia, an engineering outfit that did worldwide

jobs, had made a detailed study of the deposit and outlined the reserves. I said to the Syrians, "They investigated this for you quite carefully. Did they tell you you had uranium?"

"Well," they said, "nobody made any great point about it."

"You see that yellow material there? That's autunite (4-calcium uranium phosphate). It's a real good ore of uranium, although I don't know what the quantities might be here."

"That's surprising. There was a place where there was a tremendous amount of it. They bundled the whole works up and shipped it back to Russia. They said they were going to work on it." They never heard any more about it, so I daresay the Russians made effective use of it in their nuclear war capabilities.

That was truly a desert job, just like the Death Valley, California, area. Although we did do the preliminary engineering work on it and a lot of the test work, and it was possible to upgrade the material to a saleable product, I don't believe they ever went ahead and did it. However, in Jordan were very large phosphate plants. There was a significant market--shipped out of Aqaba all over the world--for their phosphate products.

Uranium Plant in Yugoslavia, 1972

Jensen: We did a uranium job in Slovenia, Yugoslavia. Here we did the preliminary engineering, plus all the designs except for the construction. They told me when I left Lubyana, after presenting the proposal, "You have the job; go ahead."

I went back to the office and said, "We have the job."

They said, "We don't want it." They turned it down. We had a couple of other jobs going over there in copper/nickel and they said, "We don't want two or three jobs going on in that country at the same time." They were just concerned about getting spread too thin.

I was quite surprised at the nuclear capabilities of the Yugoslav research people who were, of course, interested in developing a uranium capability in Yugoslavia to be able to say, "Well, we'll hopefully have the bomb at some time." It was a very interesting and challenging job.

I told the Yugoslav people, "The first thing I must ask you to do is to analyze every stream and body of water in the vicinity of that proposed uranium operation. The reason for that is this: after you start the plant, you could never prove who put that radioactivity in the water. If it was there before, you are home free. But if it wasn't there, and you put it in, then you have to look into your operations." They proceeded to analyze them all and of all the things, next to the plant where we were proposing to place it, the stream was quite radioactive.

Swent: Naturally.

Jensen: Natural radioactivity. But the mine was a couple of miles away, and we were going to haul the material up there. So when I went out and looked at the place, I said, "This stream is radioactive. Do you know what I think? I think if you went across that gully, I think you are going to find a deposit over there." It was. So we didn't haul the stuff for the two miles, they just went in and drove a hole in the side of the hill and took it out right there at the plant.

Swent: So you found a mine for them as well?

Jensen: In effect. We found where it was very close at hand. I'm not any great shakes as a geologist. Our company had suggested to them as far as disposing of waste materials and waste solutions to drill a well, which is done sometimes in this country, and pump them into the ground. I was very much against our people making that recommendation. I said, "That's a dolomite country. Underground in some of those you find tremendous caverns of water which may also connect to the ground water supply. If we get into one of those and pump radioactive material in it, we just might ruin the ground water supply for everybody in that valley. The other thing is we have to be very careful on the stream because I understand the river is Marshal Tito's favorite trout stream. We don't want to get in trouble there, not with Tito." [laughter]

Unfortunately, we didn't get a chance to build the plant. It was built, however, by Fluor. They built ponds to retain the material and then recycled the solutions which is, perhaps, a little more expensive in some situations but it is certainly a lot safer. I know from the plant we built up in Southwest Africa, I didn't work on it all the time, but its water situation and disposal were critical even in the desert.

Swent: Where was this?

Jensen: In southwest Africa in a place called Rossing. A very large deposit, and in fact, it's probably the world's largest uranium

plant. It is running still today. There, of course, the tailings were quite a problem because there was a tremendous volume of them. What I wanted to do was put the fines into a sump area and cover them with rock material. In other words, it was so dry--the country was practically drier than Death Valley--you didn't have to worry about a ground water problem with rain coming down. The main thing you had to worry about was blowing dust. If you covered it up with a rock that came also as a byproduct, you could mitigate that difficulty. I don't remember now how they did get rid of it but I know they didn't spread it out in great big open places to let it blow. That just wasn't done.

Uranium Plant in Argentina, 1975

Jensen: The uranium program in Argentina was a study that was made for the International Atomic Energy Agency of Vienna for the Argentinean Atomic Energy Agency.

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Jensen: I spent quite a period of time there. We looked at all the mines and operations of the Argentinean Atomic Energy Agency in the northern and central part of Argentina.

Swent: So you were checking much of the country.

Jensen: Oh, yes. We checked all the operations that they had, including some of those that were not associated with the recovery of uranium from mines. I recall going by one of their buildings in Buenos Aires and asking, "Mark, what are you doing in that building there?"

"We're making plutonium."

Which rather shook me up because at that time, all the U.S. news in the papers was how the United States was going to keep everybody from making plutonium and having access to nuclear weapons. I thought now here's a country, certainly not a Third World country, but you wouldn't expect to see them engaged in an activity of that type. But they were a very fine group of people to work with and we had excellent cooperation from them. They had some good deposits and we made a study as to the end costs for one of these that satisfied the requirements of the International Atomic Energy Agency.

But we did have a contract problem when we went down there because, unfortunately, practically when I got on the airplane in San Francisco, I was handed the contract. When I read it on the way down, with the two other fellows with me, I realized that we were in a horrible position because whoever signed that contract didn't have enough money and time in it to do the scope of work that was set out. It was just utterly impossible.

I got down there and I went to see the man heading the office in Buenos Aires, Hector Ferraro, and I said, "Hector, I think I've got some trouble." I knew Hector from before, a competent engineer and manager.

He looked at it and he said, "Well, you certainly have."

Swent: Who did he work for?

Jensen: He worked for our company. It was our office down there. In fact, they were working on a couple of nuclear power plants down there. They weren't doing the nuclear end of it; they were just doing the civil end of it. I said, "You know your way around down here. What do you think I ought to do?" He said, "Well, Jim, the only thing I can see to do is level with them."

"Okay. I'll try that."

Well, we went in to meet the principal people in the Atomic Energy organization. This older man came up to me, shook hands with me warmly and said, "Do you remember me?"

"Yes, I think so." In the back of my mind I was thinking where in the world I had ever seen him before.

"I was in your office in San Francisco several years ago. You were extremely helpful to me. You gave me a lot of information on uranium and told us a lot about it. Then you took my wife and me to lunch on Treasure Island. Then you drove us around the town just to show us the place. It was the high point of our trip to the United States and we will never, never forget it. Now, what can I do for you?" It turned out he was one of the principal people.

I had never expected to have such good fortune. We treated all people who came in to the office like this. This was the old mining tradition. If somebody came to your place, you treated them right. You might not show him where you kept your gold [laughter] but in any case you did the right thing, or tried to.

After some discussions with him, they agreed that the thing didn't look proper and we would all go to the representative of the International Atomic Agency office in Buenos Aires and ask that the contract be revised to a scope of work that we could accomplish.

We rewrote the scope of work. I'll never forget this lady. She said, "Well, Mr. Jensen, you ought to revise this, but I have a signed contract here by your vice president that says you will accomplish this work within the time and money allocated."

I said, "I'm sorry to tell you this, ma'am, but that man never did see a uranium plant in his life." He hadn't the foggiest idea of what he was doing. "I can tell you this. The people here at the Atomic Energy Agency agree with me."

They said, "Yes, indeed we do." And we changed the scope of work and the time so that we were able to accomplish it. We even got a very fine letter acknowledging the work being properly done. Otherwise, we would have sluffed it and nobody would have been happy. It wouldn't have been proper to do anything like this. This was ethically not the way that things were done.

But I did enjoy being with those people and traveling through the country to remote places.

Swent: Where was the plant that you built?

Jensen: We never did build the plant. We just made a study of the particular deposit, made a recommendation for a process and gave them the plans and costs and so forth that could be expected for that plant at that location. We did go through and look at all their plants and make some recommendations to them for various schemes and methods of operations of leaching and so forth, in other locations.

Swent: What parts of the country did you see?

Jensen: Oh, gosh. We went clear up to the far north, to Aguilar, and Jujuy close to Bolivia. In fact, we went up to Aguilar mine, but that was a lead-silver-zinc mine, where the concentrator had been rebuilt by WKE. What we were primarily after were costs to be used in the uranium estimates.

Then there were several deposits that we looked at out of Jujuy in the high mountains, and a leach plant also. In the town at Mendoza I met a geologist who knew Paul Henshaw, president of Homestake Mining. They, as young geologists, had tramped the Andes together seeking mineral deposits.

We also went to the plants where they were doing their refining work. The work that was done to separate uranium-235 was done in Europe. We didn't have anything to do with that particular process.

Another thing they were interested in was developing a source of zirconium from their zircon-based sands from beaches. Whether they went ahead and did it, I don't know. I sent them much information and said, "This is what has been done in the United States." Fortunately, I had the background since I had worked with the people at the U.S. Bureau of Mines Albany, Oregon, lab at which was built the first zirconium plant in the United States based on the Kroll process. They were using sands from the Oregon beaches, as well as other places, making a zirconium carbide, which was chlorinated and reduced with zinc to a zirconium metal sponge.

The reason we were visited at the Pacific Carbide plant was that they had to build a zirconium carbide furnace. None of them had ever seen such a thing. Apparently, there was none such in the United States. Well, we all went to the same AIME meetings, so we all knew each other. They came in and said, "Well, we went over to Union Carbide and the guy won't even give us the time of day. He said to get lost. Jim, we decided to come over and see you."

"Well, we don't have any great secrets here. Nor does he. Come on out and take a look at the plant." So we went out and looked and I said, "Well, what do you want to do?" So we sat down and I sketched one up for them, and they built it. It worked.

So I have one of the first pieces of zirconium made in the United States. In fact, I carry it in my briefcase. It's always good for winning a beer or something. On the back it is marked zirconium but it's a pure metal. You could look at it and you wouldn't be too sure what it was. Depending on how clever I thought the people were I would say, "Well, I'll give you three guesses or five guesses. What pure metal is this?" How many people get down to zirconium? [laughter]

Swent: Tell me, do you speak any other languages?

Jensen: Well, I had a halting knowledge of Spanish.

Swent: But you were dealing in English, I presume.

Jensen: Primarily, I dealt in English. However, I find that even though it was many years ago I took Spanish, if I am in a place and speak Spanish for two or three weeks, I start to pick it up again. I

can start understanding it. The other thing was scientific German but frankly I never was very good in German. The only purpose of using it was to figure out what was said in some of their scientific works. Much work had been done in Germany on uranium and various nuclear reactive metals since before the turn of the century.

Swent: Where were the people trained that you were dealing with in these other countries? Were they trained in their own countries?

Jensen: Many were trained in their own countries. I ran into one, Omar Valentinuzzi, and of all the things, he had been sent to the United States to get some training and where did he get it? With Dave Marcott, my old friend over there in Colorado. It was like an old home week. I still correspond with Omar. He was a very competent engineer and of great help in our study.

Swent: He was in Argentina?

Jensen: Oh yes. He's an Argentinean.

More Recollections of Syria

Swent: Let's go back to Syria, for example. Were the people there well trained? Where had they trained?

Jensen: I don't know. If they mentioned it to me, I just don't recall. But most of them did speak pretty good English. Now, in the phosphate business, some of them had come to the United States to Florida, and worked around phosphates there. Maybe they had worked elsewhere. Of course, a lot of the phosphate in the United States comes from the Wyoming area. They were a quite competent group of people.

Then they had the Russians to help them. You see, at that time, Syria was leaning toward Russia, which was unusual because most of the Arab countries were very anti-communist. The Arabs just didn't believe in that way of life. I think maybe the reason for it is many communists were atheists and felt, as far as God was concerned, there was none. But surprisingly, a lot of their equipment, the trucks that we rode in, the military equipment that I saw, practically all was Russian. I remember them saying, "But we get such wonderful deals. We are given ten years to pay off on the cost of these jeeps." I thought, they'll be lucky if they last ten years. [laughter]

Swent: Did you get any sense of the competence of the Russian engineers?

Jensen: Oh yes. I should say so, because when we went out there and they asked if I would review the work by the Russian group which I did. When they came into the meeting, they asked, "What did you think of it?" I think they expected me to say, "Oh, it's worthless. Do it over." No! This was some of the best work that I had ever seen done. I said, "It's extremely well done. If I were to tell you that it should be done over, we would be just taking your money. It wouldn't be proper at all. I'm quite willing to accept the data that these Russian people have put forth in their reports. I think they've done really an outstanding job on it."

Of course, one of the things that they had were some very marvelous maps of the country. I was much intrigued with those topo maps. You see, we have the same maps. I went in to see the military attaché and I said, "Should I bring my maps over?"

He said, "Oh, no, Jim. Don't you do that. If you want to use maps, come in my office. I've got them. But don't, for goodness' sake, bring them out around here."

You see, we used to get a lot of our maps through the U.S. Army Command and General Staff School. When I got these maps, I looked at them and I thought, my goodness, those maps are as good as anything we've got. I took them down and he and I both looked at them.

He said, "My God, they have a mapping technique that is, in some ways, better than ours. Leave them with me for a day or so, will you?"

Swent: I don't understand what was different about them?

Jensen: I'm not too sure of the technical part of it myself, but he had a feeling that actually, in some ways, they were better than the ones we had, whatever their system of aerial photos were.

He said, "Let me show you why this is important to us. Here, let's take a look at the overall area map. If you were to go down from Russia down to the oil fields, where would you go? Right through there, wouldn't you? That's why they show every rock in the road. They know exactly what they are getting into down there." Of course, that never did come to pass, but they were anticipating the possibility and prepared for it in case it were to come out that way. We in the U.S. do the same, and are as aware of situations in the world that might affect our national interest.

I also visited Palmyra, which was Queen Zenobia's palace there 4,000 to 5,000 years ago, an ancient city, and it was a fantastic place to see. We would be out there in the desert and we would run across castles, long abandoned. I would ask the Syrians, "Where did these castles come from? Who were the people who built these?"

"We don't know. They were here when the Arabs came." They were just lost in antiquity. It's amazing when you come across something like that. I know the fellows that worked for Standard Oil Company who did the same thing in central Arabia in the early days would run into ruins like those and nobody had any idea where these ancient civilizations came from or went. They were long gone, and left no records.

I guess I told you the little story about hoping to see the fellow who later became the president of the country over there, who was in jail in Damascus when I was there.

Swent: I would like to have you tell it again.

Jensen: Before I went over, we had a man who worked in our company, Kalin Atassi. He was from Syria. He heard I was going over and he said, "Would you take a letter over for my father?"

"I would be happy to do it. But I don't know Damascus well. It's a city of a million people. How in the world would I ever find him?"

"Here are names of some people you might ask for, that you could find maybe easier than he."

I went in and talked to the Syrian government officials. One of them had the name of Atassi. I said, "Are you of the Atassi family from Homs in Syria?"

"Oh yes, indeed, I am. You must know a great deal about Syria to know that our family is from Homs."

"No, really I don't. But a Kalin Atassi works for us at Western Knapp in San Francisco. He asked me to bring a letter over here to his father."

"Oh, I'll be happy to take you to see my uncle."

This was very straightforward and I had a very wonderful visit with them. But he had a brother who was in jail, the one I showed you the picture of. I didn't want to raise this question with the family so I went to the military attaché and I said,

"I've thought about visiting this man, but what do you think of it? I don't want to be an ugly American."

"No, no. Stay completely away from him. What you may construe to be a kindly and compassionate act may be completely misunderstood out here." He said no way, so his advice was heeded.

I don't believe it was a month or two after, and that fellow was head of the armed forces and Syrian president of the country. And from jail! I was simply astounded. Things happen fast in that part of the world.

Dead Sea Potash Works, Jordan, 1962

Swent: I guess they do. I have a note here that says impermeable dikes.

Jensen: That was down on the Dead Sea. We did this job for the Arab Sea Potash Works. That was a Jordanian company. Of course, in Israel, there had been a Dead Sea potash works for many years. They were evaporating the water from the Dead Sea and it drops out an evaporate solid called carnallite. This carnallite can be just simply put into fresh water and you will separate out a potash which can be recovered by flotation. In the industry, it is called "frog hair." It was generally a poor grade of potash and difficult to use, being too fine, although it could be acceptable from the standpoint of some fertilizer materials.

Well, when we tried to convince the people we were doing this job for, they wanted to do in Jordan exactly as it was then being done in Israel. I said, "Oh no, you don't want to do it that way. In the United States, we have plants that use flotation to recover potash down in New Mexico. That's a very different situation than here. There they have silvite ores of a type that is more amenable to separation. I feel we must also include a crystallization system."

Finally, after a lot of discussion, they agreed it would be okay to do that, so we put in a two-phase approach to the project, flotation and crystallization. Before we finished the evaluation, it was announced in Israel that they were going to go over to crystallization because they were just having too much trouble. They killed much of the rice crop in Japan by shipping over potash that they had put too much anti-caking material into, and didn't realize it was poisonous to rice. It really upset their market.

So they went to crystallization and confirmed our analysis of the situation, well known in the U.S.

The Jordanians had a pilot plant on the north end of the Dead Sea which used the flotation system. They brought me over to it and said, "Well, would you like to see this plant work?"

"No, I'm sorry. I don't want to see it work."

"Why is that?"

"I don't want to be a party to it. Nobody can make this plant work as it's set up right now. It's impossible. If you tried to make something for me and I stood and watched you and it wasn't a material that you could do anything about, even your board of directors would feel I didn't know what I was doing. If you want to make a run for me, I tell you what you must do. I want you to completely clean this plant. I mean, every nook, corner, and cranny of every tank, vessel, pump, line and everything."

Because what they had done, they had put mud in with the carnallite feed, and mud and flotation don't get along together at all. I said, "Now, you have a big field out there of carnallite, beautiful material. Harvest about a couple of hundred tons, or whatever you need to make a couple of days run. I don't want to see one shovelful of dirt in it, because we don't do these things this way. In the United States, we would put this on a salt base from which we could scrape the carnallite up and never get any dirt in it."

So by dint of great effort, they did that. They ran the plant and for the first time in all the several years that they had been working on it--and they had a fellow from the United States helping them who was from a United Nations agency, but was giving them zero advice--by golly, they came out with a 96 percent potassium chloride. Wow!

So I took a sample of it. It was beautiful, light clean stuff. At a meeting of the board of directors, I pulled it out, poured it on the table and said, "Gentlemen, there is the potash from your plant. Now, you've never seen any like this before, everything else was brown and low grade. This is the grade that will sell all over the world."

"But it's no good. The reason it is no good is because this is what we call "frog-hair" potash. [laughter] You can't sack it, you can't run it, you can't do anything to handle it that is going to be good. People in Israel are having that same trouble.

So although we know that you can do it, we would still strongly suggest that you consider the crystallization system; but we'll give you both answers."

But when the project was done, the plant was built on crystallization and it works. The products are shipped out of Aqaba. Of course, at that time there was a big argument as to where to put the plant. They were very worried because where the plant site was, we could look across and see the plant that was in Israel. It was about four or five miles away. They said, "We don't want it so close. We would like to put it up on the mountain there."

I said, "My goodness, by the time you pump this stuff up and back down again, it would be terribly expensive."

They were worried that somebody might shoot at it or bomb it or something. I said, "Even if you put it on the mountain, it isn't going to do you any good. Good night, I'm from the artillery. If you ask me to fire on their plant over there, it isn't a question of me hitting that plant. What window do you want the artillery shell put through? That's all I got to know. It isn't that difficult to do. You must learn to live with your neighbors. I'm sorry about that, but there is no safe place in this part of the world."

They left it in the location that we had come up with. Of course, then they were worried about getting a road to Aqaba down what they call the Wadi Araba. You see, there is a great rift that goes through that part of the world there. At one time, the Dead Sea was connected to the ocean apparently. The question was to get a road down to Aqaba.

At one time the United States government offered to pay for a road through there. They didn't want it. They wanted it further back on the other side, closer to the phosphate fields which, in some ways at that time, was probably a good idea. But it wouldn't serve the potassium operations well at all. I talked to the military attaché and he said, "I don't think you'll ever get the United States to agree to put a road there."

"It sure isn't easy. Hopefully, we might be able to come up with some alternate to it." But we did, and eventually they did put a road in, but I think they paid for it themselves, rather than the U.S.

Swent: Were you dealing with Syrian government people then?

Jensen: No, the Arab Potash Company was a company that was selling stock and actually was a private company. I'm sure the government had quite a bit of influence on it but theoretically they were a private company.

The president of Jordan Potash Company was also the president of the Arab Bank. Of course, we used to keep our money in the Arab Bank in Amman. He had lived in New York City so he spoke good English. It was no problem to chat with him. He said, "You're very unfair to us." I remember he said that at one time.

"How's that?"

"You come to our board of directors and you always bring Hisham Nuseibeh with you." Hisham always sat at my right hand. "You know that Hisham knows us better than we know ourselves." He was born and raised there, so there was nothing they could say to each other in Arabic. Hisham, as I said, was my right-hand man, although when I brought him out there, his purpose in the organization was to design the non-process facilities for the plant, which he did. But very quickly, when I saw his capabilities--I never let anybody ever see him work on a drawing board. He always worked in an office. He did his drawings at night, in the evenings and so forth, because it was important to keep his stature up. In other words, he was not just a man who was a laborer, so to speak. That man had capabilities far beyond just the ordinary draftsman. Sure, I could sit down and do drafting myself, but it is better to have somebody who is faster and more clever about it who lets you do the thinking on the project rather than spend your time drafting.

But the people there were wonderful to get along with. Many were people who had been displaced when Israel took over and the Arabs were forced out of their old homes.

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Swent: These are the Syrians?

Jensen: These were the Jordanians, and I daresay some in Syria, too, because there were tremendous refugees camps, and when you went through them it was saddening to see these people who just had nothing. They put them to work doing little jobs like working on roads. Everything was done by hand so that they could use lots of people. In fact on the potash plant project they said, "Oh, you say you are going to use three people in this section of the plant."

I said, "Yes, that's what we would have had down in Trona, California."

"Oh, but we can't do that. We must have more people working in there than that."

"Well, we can get them in, but I don't know what they'll do; the way this plant operates."

The same thing was true in India. We offered a contractor-supplied sulfuric acid plant for Khetri Copper and I think the original plan on that thing called for twelve or fifteen people. They didn't like it. Somebody else came along and offered one that had maybe sixty or eighty people. They thought this was much better. But when another company came along where they needed about two or three hundred, this was wonderful! They had tea-makers for the tea-makers. It was make-work, as are a lot of the jobs in various parts of the world, trying to keep somebody gainfully, hopefully occupied.

Swent: You had to be aware of some of those cultural implications, then, didn't you?

Jensen: Yes. Well, the thing that you didn't do was you didn't, you might say, make disparaging remarks about it. That was their way of life. So you accepted it, conformed to it to the best of your ability, but pointed out how this was what was done in the United States in our situation, the bottom line question was operating costs and being able to meet world market prices.

Swent: You had mentioned that you had to consider this when you wrote your report.

Jensen: Oh yes, and you always made sure that your words were exact, because people abroad read every word of reports by the dictionary, so to speak. Where we would use some well-known expression which doesn't translate out properly, it could cause them to be very upset with you because they feel sort of stupid. They are not, but they feel that way. They are embarrassed to ask, so what do they do? They end up by being annoyed and mad at you. That's not a good situation at all unless everybody smiles and accepts these things.

I recall being caught one time on "carboret de bore," on a job we were doing for a French possession. I couldn't figure out what in the world that was and I couldn't find it in any dictionary. Finally, I went to a French engineer who worked for the company. I said, "What in the world is carboret de bore?"

"Oh, that's calcium carbide."

"Calcium carbide? But it doesn't even resemble the formula for it."

"The reason it was called that was that there was a mining town where it was first used in France. People just gave it the name there and it has stuck with it ever since." I guess we have a lot of expressions that are somewhat the same way.

Actually, one of my problems in the engineering department at Western Knapp and later, Davy McKee, was to review all engineering reports and make sure that they were very explicit, very plainly written. The other thing they were to be set up in such a way that the introduction might be a page or two and a summary, which we would try to keep on one page, because the financial people who look at these reports, don't want to read the text or back to the supporting appendix. They couldn't care less for that. One page, graphs or a chart, or something like that, or a couple of charts and a cash flow chart, a summary from the financial standpoint, that's it. Will it work, will it pay--those are the two big questions that must be answered affirmatively.

Now, if the client wants to go through the rest of the report, volume after volume, and find out exactly how that plant is going to work, that's great. But that has to be done properly, also. Layout is extremely important. I know this was true down in South Africa. We had a joint venture with the Bechtel people there. Many of the Bechtel people, engineers, wrote reports; they would come in with seventeen alternative ways of doing something. This you can't do. The Command and General Staff School said--and this goes back to somebody like Aristotle or way back then--if there is more than three ways of doing things, your thinking becomes confused. So we would always reduce it, try to reduce it, if there were alternates, to three of the best, not just overwhelm the client with a bunch of ways of doing it and then not sort them out for him because that's what he was paying you to do anyway.

I taught courses in the company and also put out report writing procedures, books which I still have here. Everybody who came there received a book. While I was going through my files here, what do I find? I found a book that Standard Oil Company had given me on Bahrain when I was supposed to go out there and didn't make it because of the war. It's good to keep your people clued in as to what is going on in their world, how things should be done in the best interests of the company, and in their own professional work.

Swent: So you did train people before you sent them out?

Jensen: Oh, yes. We were very cautious about that, particularly if they went out to interview a prospective client. The worst thing in the world is to have somebody go out on an interview who doesn't know the client's business. He'll be found out in about twenty seconds. So if we had people that were going out, I had tremendous files, which I maintained over the years and still have yet, of every industry.

Now, it might be something I wasn't too familiar with, but if somebody was going to talk to them, I would say, "Here, take this file on vanadium," if that was the plant, and "go through it. If you have any questions, let's discuss them, and bring in others who have been in the business. Be doggone sure that you know how the client talks, and what he's talking about." I found that worked very, very well.

The only time I was ever embarrassed was with a couple of vice presidents who came in and threw in remarks. I remember one with the president of the Great Salt Lake Minerals and Chemical Company. It was a big meeting. The vice president of our joint venture partners in San Francisco, a well-known engineering company, was there and he started in saying a lot about what he was going to do and how they ought to be doing it.

Harold said, "Jim, I've got something important in the office to chat with you about." So I went in his office.

He said, "My God, where did that man come from?"

"He's the vice-president. You know that outfit."

"We don't want him around this job at all. That man doesn't know our business." I said I guessed that maybe the vice president was just talking off hand about that whole situation. But he said, "If he is the vice-president, if he has anything to say about how it's going to be done, I don't want that guy around." This was the president of the outfit we were working for.

I said, "Well, Harold, I don't think he'll get into design phases of it, certainly." I didn't want to embarrass the fellow or anything like that.

I even saw our own vice-president doing it on a couple of occasions. I was just appalled. I would just sit there and practically shrivel up. What will these people think? The things he was saying just didn't make sense. In fact, on a couple of occasions it cost us a lot of money.

One of them was in India. Our mining engineer, Andy Anderson, had made up the drilling program and an evaluation of the reserves of the deposit. It was an excellent job. He later became the vice-president of one of the big copper outfits back East. McKee/WKE then sent a man out to India as a field mining engineer, but he didn't know anything about it. He told the people in India that the work that was done was no good. My goodness! So they complained to the financing agency. The next thing we find was that the client said, "Well, we are going to have to either redo this drilling program, or you are going to have to redo it at your expense." Bankers set great stores on reserves!

Then the vice president, whose knowledge of mining was nil, went out there, of all things. He came back with a bunch of pictures. I'll never forget these as he said, "I think Orville is wrong. Look, I took these pictures and this is what I see."

I said, "He's not wrong. I don't know what you took the pictures of, but he is right, 100 percent." Orville was sitting right there, taking this all in, because he was getting a lot of static on the situation.

Finally, it ended up we had to retain Ira Joralemon, who was the top copper man in the country, and his son Peter, both outstanding in geology and mining, to go out and look at the situation, the test work, and drillings and all the rest of the stuff and come up with his answer. Of course, Ira received and deserved a mighty healthy fee, for this. And since the client refused to pay the cost as it originated in WKE, the company had to pay.

Our mining man, Orville Anderson--we used to call him Andy--was very disturbed, of course, but when Joralemon put out his report, there was no question; the original evaluation was 100 percent A-Okay. Everybody was relieved; I certainly was, but I went to Andy and I said, "We're vindicated."

He said, "You stuck up for me."

"Sure, I stuck up for you. The laws of probability say with the pattern of drilling you used there and the results you came up with, it's impossible that you could have been wrong. It would have been just one chance in a billion. It just wasn't there."

"Yes, but the vice-president, he didn't do much for me."

"Yes, but here you're vindicated."

"That's okay, but I'm not going to work for that man again. I quit." He left the company. He just would not accept that kind of illogical criticism of his obviously very able and great ability in that field. He went on to greater success outside and I regretted losing him.

Swent: Did you go out to India at all?

Jensen: To India? No. We had others who went there, and they put shafts down and the plant was built. People brought pictures back, showing native people carrying the concrete up in head baskets and excavating with hand shovels. The scaffolding was put up out of bamboo. A very primitive place, but it did work out. We put Ted Olds out there to sink the shaft. He was from the Bunker Hill Company. With all the finest equipment we could get, with this same shaft-sinking equipment where in the United States would have gotten maybe six feet a day, at the very best they could make six inches a day out there when we could get them to put on shoes. They just apparently didn't have the capability for knowing how to do and what to do. Yet they had the identical equipment in the United States. It required much painstaking training.

On the wire rope to suspend the cages to go down into the mine, we went out and got bids from the United States, Germany and England. "Oh, we must have Indian wire rope, because we make wire rope in India."

We said, "Oh, okay," but the man who was head of the Indian Bureau of Mines said, "No way. I won't even go down with an Indian wire rope. I'll never get in that cage, under any circumstances." He would not approve it. So the wire rope had to come from--. I think it came from the United States.

Then they wanted to buy all the hardware in the shaft. So they went to one manufacturer and they bought bolts, all kinds of bolts, real cheap. Then they went to another one and bought the nuts to fit those bolts real cheap. Guess what?

Swent: Didn't fit?

Jensen: The nuts wouldn't fit. They bought Indian pipe that was supposed to be good for 150 pounds per square inch. It just opened up like a tin can at fifty pounds, just blew out. A lot of their workmanship on products out there was just utterly impossible as far as our requirements for safety. The air hoses just blew away. It was trying for the people who were out there. I didn't go out but I remember the train of comments to the home office.

Swent: I remember talking to Orville Anderson later and he told how terribly ill he was there. He was very sick the whole time. He said it was the only place he had ever been where he just absolutely could not remain well.

Jensen: Yes. And the other person who got sick out there was our mining engineer, Jim Edmonds. He picked up something that the doctors never really did run down. I said, "Look, I'll tell you who probably knows the answer to this--I don't know what doctor you are going to--but if some way you can get up there to the army hospital, they have seen every thing in the world. Somebody has seen it or knows of it. Go out there to Fort Miley." I don't think he ever did, but that's what I would have done.

Swent: I asked Orville, "You could always eat bananas, couldn't you?" He said even the bananas were infested there. Even the bananas were not safe to eat.

Jensen: I liked Orville. He was just a fine guy. He gave a talk on their mine up here, the one at Jamestown to the women's group of the AIME. He got up and he said, "There's Jim over there; I used to work for him." I got quite a kick out of it.

Then he was telling about this young lady they had as a geologist up there at Jamestown. They had some adits that went underground there at that old gold mine. They put off a blast, and later she and a workman there went into this adit and, boom, down they went. No air. Just the air was exhausted of oxygen.

"Gee," he said, "we had an awful time getting her out of there. The fellow managed to crawl out and get help and they managed to get back in and put her in the hospital. I went in to see her and she said, 'Okay, I knew it was stupid to go in there without checking it.'"

That's why I carry a carbide lamp. If that lamp burns low or goes out, you better get out. There isn't enough oxygen left to support you. Many old mines in the Sierra have this problem. Even if you carry a candle, you are safer.

Orville is an extremely competent person. He came from Saskatoon and I remember visiting his home up there. At that time he was working for one of the potash companies up there and put a shaft down. He was kind of an expert in frozen shafts as was Jim Edmonds, the other mining engineer.[1] I've kind of lost track of

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[1]For more on shaft-freezing in Saskatchewan, see the oral history of Robert E. Kendall, in process 1993.

him here. Recently, he was living up in the Sonora area. But I don't know whether he is still there yet.

Swent: I think he has left.

Jensen: The mining world is a small world. I've made that point with people many times. There is hardly any place in the world that one could go, and not either know someone or know of them, or you had mutual friends. The true miners, who do not always know if they are an inch from a million dollars or a million inches from a dollar.

Swent: We're jumping around an awful lot here, but you might tell about the case where your friendship with the Jordanian army captain helped you out of a jam.

Jensen: Oh, he helped me out of the jam down there on the dikes. I made the point on proper dike design to the people of Jordan. They wanted the dikes built just exactly as they were being built over in Israel. We saw them building dikes near the plant on the other side. I said, "No way. Under no circumstances will we build a dike like that. If you insist on having them done that way, we don't want to be a part of the job. They leak. You can tell it from here, five miles away. The thing to do is we ought to just go out and take a look."

Now, this of course was illegal. You weren't supposed to go out and go around the border at all. They were trying to maintain an armed truce in there. This was in 1961 or 1962.

So in any event, the fellow who was the consultant for the people in Israel on dikes was a friend of mine from Holland, Dr. Adrian Volker. At any rate, he was consulting for them, and did know the business. The technique that they were using to build the Israeli dikes was just 100 percent wrong; and dumping of fill. At any rate, a group of us decided to go over and look. So we went out on a long old old-time dike that led over into Israel across some old pans out there. When we got about halfway across to the border and the dikes, I said, "Do you fellows want to go any further?"

"Well, yes. What's the problem?"

"Do you see what I see on the end of this dike?"

"We don't see anything over there."

"I do. I wasn't around my rich uncle's army for twenty-five years for nothing. I tell you, what's on the end of this dike is

a pillbox. Walking up on one of those will result in what we call non-habit forming accidents, and we may be too close now. It's got me a little worried."

We took a pair of field glasses and looked and got out on the flanks and looked and kind of studied it. Finally we decided it didn't look like there was anybody there. We took a calculated risk and walked up on the thing. There wasn't a soul in it. It was a pillbox; there was no question about it. We stood on the parapet and looked up and down the border. There were others down there but nobody in any of them. Apparently, they hadn't been used since somebody had threatened invasion I assumed, of Israel. There were a couple of Arabs working; one of them said to the other in Arabic--I couldn't understand but the Arabs told me--"Well, here come some Arabs to look." We looked like a bunch of California tourists actually.

In any case, we looked and sure enough, the dikes leaked. We headed on back and before we got to our trucks and jeeps, we were descended upon by this company of Jordanian infantry who pointed rifles, pistols, and tommy guns, and everything else at us and ran us into camp. They had not seen us go out, but they had seen us come back so they assumed that we came back from the other side. (Israel) So they started in to quizzing us about our activities--it happened to be the day I didn't have my passport with me so I couldn't prove who I was.

I said, "But I must see your Captain Amari."

"Ahh, you know our Captain Amari."

"Indeed, I do. If you will ask him, he will say that I am all right. I belong down here on the Jordanian side."

"He is not in the camp with us. He is away."

"Please get in touch with him."

So they went to work at that and in the meantime, quizzing us about things. Finally the word came back to let them go, because we are friends. Then they were quite contrite, feeling that here was a situation that was embarrassing to them. I said, "Please, don't let this embarrass you a bit. We were in the wrong. We went out there and we know we weren't supposed to but we had to take a look at the dike situation. So you did the proper job in taking us into the camp. You've done it in a professional way and I commend you on it."

They felt quite a bit better and invited us to have tea. The fellow who was with me from the United States, who later took over on the plant, said, "Oh, tell them to go to hell."

"No, we never do that. When we leave here, everybody's going to be smiling and happy and when we come back again, they will be the same way. That's the way to live." But this Captain Amari was a very striking man, whom I had taken a picture of quite some time before and visited at length. I made him a bunch of 5x7s because he wore an unusual uniform with a spiked helmet of the type that was used in the German army in World War I. It was a very unusual uniform in fact. I know he appreciated the pictures and we used to visit and got very well acquainted.

That's a good way to get around in a country. Make some friends, kind of get the feel for the place, never talk down to them. Life is far less complicated than if you're always being controversial. With that plant, we got through with the initial work; it came out all right. It came out on budget. It came out with a good recommendation. As far as I know, I think the price was probably all right, except they did go back and build a bigger plant than what we had suggested originally. We told them 100,000 tons a year; I think they doubled it or something like that.

But the thing there is to be sure you build a plant that is large enough to be economic. If you build a plant that is too small, then you are always in trouble. But then we did have the big advantage there that we had Hisham with us, and his family being in the government, we had opportunities to do things that you didn't normally have.

We had one of our competitors over there, and I got to know him well in later years. He told of us being out there, but I knew him well enough that I didn't tell him who had him run out of the country. [laughter] I told Hisham, "We don't need that guy in this country. He is one of our competitors. What are you going to do? Talking of those people would be upsetting the whole thing. Get rid of him." The guy left. The word came down that it was no place for him out there. He got the word. So sometimes, it isn't what you know; it's who you know.

XI LAKE MINERALS CORPORATION, 1977-1981

Swent: Would you like to say a little bit, then, about Lake Minerals Corporation?

Jensen: I took an early retirement from Western Knapp Engineering because it appeared that things were getting very slow. Of course, all engineering companies are that way, as they have their periodic ups and downs. I had been there for twenty years and the opportunity to take an early retirement was a good one, so I took that. But before I finished negotiating with it, the fellow who was president of Lake Minerals, being a long-time friend of mine, Bill McClung, who had worked at Iron Mountain--he had been president of that operation out of Redding and later vice president of Stauffer--got hold of me and said that they were working on the Owens Lake deposit down there and since I had worked with AMPOT [American Potash], would I be willing to come to work for them and be eventually a vice president of engineering?

We didn't have that big a company, but there wasn't that much "vice" in it, as we used to say. So I took that and it worked out very, very well because I was able then to buy into the company and when the company was sold out to COMINCO, it was very advantageous for all those within the group. COMINCO still maintains the operation down there.

Essentially, it was harvesting the salts on the Owens Lake, the salts that were left after the city of Los Angeles drank the lake dry. The aim was to develop a plant plan for soda ash recovery. The operation as far as recovering those salts (it looked like dredging and conventional carbonation was the best way) as far as the processing was concerned. It was pretty standard in the industry. We came up with a number of process and economic studies, talked to several companies in addition to COMINCO on the purchasing or taking over the operation. Finally COMINCO did and is currently, in joint venture with Vulcan, working up plans for a major plant.

Swent: This was similar then to the American Potash chemicals?

Jensen: Oh yes, very similar. Actually, there is borax up there in that lake also. There were several companies years ago, very early in the game, companies that recovered soda ash and trona, which is a mix of soda ash and sodium bicarbonate. They originally shipped it on the old railroad that went over the Sierra to Virginia City. Then it was shipped to somewhere south of Oakland to a plant which took the borax that was brought out on the twenty-mule team from Death Valley through Mojave. The reaction of trona and calcium borates results in sodium borate for which there was a wide market.

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Swent: This is long before your time.

Jensen: Oh yes, long ago. It was many, many years ago.

Swent: Were you mining borax?

Jensen: At American Potash and Chemical, borax came up as part of the brine solutions from Searles Lake.

Swent: But at Lake Minerals, were you mining borax?

Jensen: We also had borax in the solutions.

Swent: Were you extracting borax as well?

Jensen: We didn't do any of that at all. All we did at Lake Minerals at the time I worked there was to take the solidified material, dried it and shipped it to Boron to U.S. Borax and Chemical Company. In their open pit there, they had great quantities of sodium borates plus colemanite, ulixite, and probertite, and those reacted in the dissolving operation with the materials that we sent to them. I figured that it probably raised the plant capacity at least 10 percent or more. I am just guessing at it, but I'm sure they did get a significantly better recovery. The other thing is, in adding that trona material, the crystalline structure of the product is such that you can filter and handle it much easier. You have to have the right pH in the solution in order for that to happen.

Swent: So you weren't processing it; you were just shipping?

Jensen: We were just shipping this material, right. All we did was dry it and haul it down there in big trucks. They would put it into their dissolving system. The dissolving system took the materials

that came out of the mine--it's an open pit mine now. It used to be an underground. In fact, I was in the underground mine years ago. Otherwise, they would have had to put the calcium ores out, just stockpile them and treat them separately. In this way, they could do the whole thing together. So it worked out very well for them.

What has since happened is that my old outfit, American Potash, has what we called a trona dike out on the northeast part of the lake. That was where we used to throw away our terrible junky solutions and so it was pretty much contaminated. But in later years, they decided to clean it up, mine it out, and ship it down to Boron. Unfortunately, it is much better than what we were shipping out of Owens Lake because there was no mud in it. The stuff we had had a certain amount of dirt and dust that blew off the surrounding country there. It ended up by COMINCO losing the contract out there.

So they are working more intensely now, an association of COMINCO and Vulcan Materials. In fact, they are working with the descendants of the Western Knapp Engineering group at the office in San Ramon doing a study on recovery of the Owens Lake salts, particularly of the soda ash and probably the borax too. I mentioned to one of them the other day, "Well, if you need a consultant, I'm available." I have some of the original and old reports of Keeler when it operated in the Owens Lake in the twenties and early thirties.

Recollections of General Dwight D. Eisenhower

Swent: Would you like to share some of your recollections of General Eisenhower?

Jensen: Well, my daughter, after she got out of college, decided she would join the air force. So she got a commission in the air force and was on active duty there for some little time. She had the opportunity to be interviewed for a job of being something like a secretary to the general. This type of secretarial work was by a military person who could handle classified information and be a part of that. He had a small military support group. He had a brigadier general, whom I never met, and also had Secret Service, staff support, and civilian administrative support staff.

Swent: What is your daughter's name?

Jensen: Nancy Ann Jensen, at the time. Now she's married; the name is McCarty. In fact, I built a boat called the Nancy Ann in the South Pacific. I would always kid her about it and show her name on it.

Swent: Where was she with General Eisenhower?

Jensen: The general and his wife, in the summer time, lived at Gettysburg, Pennsylvania. In the winter time, they lived down in Palm Springs where he was provided a home. It was right in the golf links there.

Swent: This was after he had retired.

Jensen: This was after he had retired and after he was president, up until just before he passed away.

Swent: But he still had military employees?

Jensen: Army. As far as I know, they were all army.

Swent: I thought you said your daughter had been in the air force.

Jensen: Well, air force. But the other two were army primarily. I don't know why they took her out of the air force. I guess there were army people available too, but she always felt very happy about it. She has a tremendous collection of memorabilia. I have one of his autographed books. I always had a high regard for him. I had the opportunity to meet him through Nancy down there and visit with him and chat with him for a while.

I recall I asked him a question: "Of the troops that you remember from the European theater, are there any particular ones that stand out in your memory as being really outstanding?"

He said, "Yes, the 442nd."

That's the group of Japanese, from Hawaii. They made a tremendous record for themselves out there, in spite of the fact that there we were with Japan as an enemy. Nevertheless, they did very well.

So she was with him and did a lot of his regular work. I think part of it was probably done by other secretarial help. Anything that had to be done that was unusual, she did. She had an opportunity to meet all these people like President Johnson and Freeman Gosden, who was a great friend of the general's. They would all come into the office and chit chat.

She lived down near Palm Springs with the Odlums. He had been in the uranium mining business. He was married to the famous woman aviator. She set some records and so forth.

Swent: Jackie Cochrane?

Jensen: Yes, I think it was. I'm pretty sure that was it. They had a tremendous home out there and had an office there which they made available to the general. My daughter lived in an apartment on the Odlum Estate Ranch, so she got to know them very well, also.

Mrs. Eisenhower, you know, would not ride on an airplane. They always had to take a train back and forth. They had a special train that came to pick them up. It went back by way of his old home town back where he is now buried.

Swent: Abilene, Kansas?

Jensen: Abilene, yes. I was through there a couple of years ago and it is a fantastic memorial to him. Then back to Gettysburg and then, following the summer, he repeated. They would come back the same way.

Swent: It must have been a wonderful experience for your daughter.

Jensen: I should say so. She was very much impressed with the general. I got kind of a kick out of it. I said, "Well, you realize now, you are with the old, Old Army. This is going to be a very unusual thing for you, because there aren't too many of them left anymore." She found that to be true, that they were really very wonderful people. There was just no question about it. In fact, she kept in touch with Mamie Eisenhower until Mamie died some years later.

The other thing she wouldn't do--. People came to her. "Oh, I wanted to talk to you about the General." No way. Nothing about the family. "I will not talk to you. Not under any circumstances, will I tell you anything about that family." Some time later the general's grandson came out. He writes books and so forth. He put on a program here in San Mateo so I got Nancy up there. They had a tremendous meeting because when she knew him, he was just a young fellow then. But he remembered her and she was very happy to talk to him. That was a fantastic opportunity for her.

Swent: She didn't stay in the service?

Jensen: No. Of course, part of her purpose to get into the air force was to look for men. Where's a better place to look? She found one,

married him, and resigned then from the air force and carried on ever since. She got into the real estate business and did all right for herself.

Swent: How long was she with the general then?

Jensen: About one year, something like that. Offhand I just don't know the exact time. It was long enough that she got a pretty good appreciation of the whole situation.

Swent: That must have been very exciting. Well, we've covered all the things that I had on my notes, Jim. Is there anything else that you would like to say?

Further Recollections of World War II: the Philippine Islands

Jensen: I went in at the Presidio here and went to various places in Southern California, down in Texas, Fort Bliss, training back in the chemical warfare school, also artillery school. The first outfit I was with, I went to, was a battalion. I'll be at their reunion here in the latter part of October. Then I joined a group and we went out to the South Pacific. We landed out there in Espiritu Santo at the place where Michener wrote his book South Pacific [Tales of the South Pacific] and then up to Guadalcanal. We were in, on, around, or over every island of the Solomon Islands.

We had some activity up there. Our group had the distinction: three Jap planes one night came down to bomb us and they got all three of them in eighty-five shots. That was one of the better records of the war, although the Marines claimed they had done better elsewhere but I didn't see that. This one I did see. Of course, they dropped a few bombs but they didn't get back to tell their friends how well they had done there, if at all. And they didn't; they didn't hit anything. After that, we never got much trouble from them. I guess they decided it was too hot a place to tangle with. Or maybe they were out of airplanes at the moment.

Swent: You were working with the Seabees?

Jensen: When I say working with them, there were many, many Seabees out there. There were organizations. They were an outstanding engineering outfit. They were just like the contractors in the United States. Unfortunately, army engineers--they were well equipped--but I always remember, one island I was on, you could

hardly get up the road to get to their place but every bit of the equipment was sitting there, shined up just like it was to undergo an inspection. But if you went into the Seabees, the road that went up there was absolutely perfect. You could have driven up it at 100 miles per hour, and all their equipment looked like it came out of some contractor's yard here in the United States, but they got the jobs done. They did a wonderful job. They were outstanding people. I have a soft place in my heart for them.

I went on to the Philippines and I was also down in New Guinea for a short time. Then just in passing, I went into the Jalimajares in the Dutch East Indies. It was interesting, the associations that you form and the opportunities to meet people and also, particularly, guerrillas, people like that. I spent a bit of time around those.

I have a book at home there by Wendell Fertig. He was a graduate of the Colorado School of Mines. He ran the iron plant out at Pambuhansir during the war. I was up there and visited the place. He was the head of the guerrillas down in the big island down south, Mindanao.

At the end of the war, I was chatting with him and he was working with a uranium outfit up in Wyoming. Our company built the plant. I was up there visiting with him. I said, "Wendell, why don't you write all these things down?" We're always sitting there talking about old times. "This is a part of the American heritage. When you are gone, who's going to remember all things if you haven't written down these."

"Well, I've been thinking about it. But I'm no writer. I've been thinking that maybe what I'll do is get a ghost writer to help me. Between my notes, memory and so on, I think I can put together..."

Well, he did. He put together this book. It was about that thick, of the activities of the guerrillas on Mindanao. These guerrillas did a fabulous job because they made it possible for the United States army and military forces to know what was going on and where the forces were and what was going on, where the proper places were to go for attack and so forth. I told him at the time, "I know you are going to write this book and I want three copies of it." The first one for me. "I want it autographed, the first one." I got it. Then the other one I gave to my roommate over there. I don't know what I did with the third one. I think I gave one to a museum or something or to the Marines up there. It was wonderful that he did that.

Then there was another fellow by the name of Segura who wrote a book called Tapunan which was the guerrilla activities around Cebu. I had been over in that area. My goodness, all these places were familiar to me and although I had never met Segura, I got in touch with him through one of his brothers who was here in the United States. I got copies of that book and I made some of those available to the Marines library there in San Francisco.Gee, here were places they described and I knew them, having been right there. It was quite an experience. I knew several people out there that were--. Well, I'll tell you one that you may have heard of and that was Chet Peters. He was a mining engineer but he did a lot of civil work. He was a graduate of the University of Washington. He was the Major X in the section south of the town of Bai Bai on Leyte. He headed the guerrillas there all during the war.

Of course, the people who were in the military service were supposed to surrender but some of them did not. But do you know what happened to them? They lost all paid allowances, retirement and everything. They were counted as deserters. But they were doing more good for the United States than anybody out there. My lord! In later years, they finally rescinded that. But at the time, the fellows looked at it. "Here, we've got this order." But then what did they do? They got into the Death March. A terrible thing to have happen. Whereas if they could have got out, at least they had some way of getting along because the Filipinos were generally friendly to them. The Filipinos didn't care too much for the Japanese. It was a shame that the army saw fit to do that because it did cause a lot of people to get lost.

I went down there one time south of Bai Bai and got a kick out of it because we went into a little town called Bato. The mayor of the town was a fellow by the name of Quezon, which is a very common family name. He had a lovely daughter; her name was Nina. Nina was a graduate of pharmacy up in the university there in Manila. So as a guerrilla, her job was to unload Japanese land and sea mines and make ammunition for the guerrillas. She never blew herself up so I guess she was pretty good at it. She was a very pretty girl, or young lady. When I got there she said, "Where do you come from in the United States?"

I said, "I come from Seattle, Washington."

"Oh. I have a friend from there."

"You do? How did you become acquainted with him?"

"He was here."

"He was here, ahead of the invasion?"

"Yes."

"What in the world was he doing?"

"He was looking for radar sites."

"Did he come at night in a submarine?"

"Yes, we took care of him."

"I'm so happy you did because he is my old friend, Homer Marcy."

"How in the world did you know him?"

"I've known him from many years back. That is his job. He goes in ahead and goes through these places. I'm so pleased."

"I have some pictures of him that he gave me." Sure enough there was old Homer, big as life. He was just a whale of a good egg. I just thoroughly and always enjoyed the guy. That was one of his jobs.

I had another roommate who was at Edgewood Arsenal. His job was to unload unexposed bombs. That organization! He said, "Now, for heaven's sake, never tell my folks what I do."

I said, "Okay, I won't mention it. You know how risky a business it is."

"Yes. Well, somebody's got to do it. I'm doing it." Lucky, I guess, we have people like that who will. I don't know whether he survived the war or not. There is a place you can send letters to find out if these people are still around. He was quite a fellow too. You run into some very wild, weird, wonderful people.

Swent: Quite an experience. I think maybe we've just about covered it, haven't we?

Jensen: Pretty well, I think.

Swent: Thank you, Jim, for sharing your recollections.

Transcribed by Chris DeRosa
Final typed by Shannon Page

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APPENDIX A

Oral History Supplement

In answer to the question of changes seen in the mining and metallurgy industries in my lifetime, these are many and varied; some observations go back to the old mines of Roman times in Cyprus, where millions of tons of copper slag still remain as historical monuments. Ruins of old smelters from Solomon's mines are known near Aqaba and I've been fortunate to have visited or studied others and compared their efforts with practices today. But the big order of magnitude changes have come about in the twentieth century.

The old methods of prospecting remain even today, but generally supplemented or supplanted by space age technology. The single burro prospector with his rock hammer, shovel, and pan has given way to aerial reconnaissance to detect anomalies of gravity, radiation, or other indications of mineralization. Rossing Uranium's large deposit in Namibia (southwest Africa) was detected by the outline of an elliptical formation on the earth's crust showing up in photos taken from space vehicles. These programs have identified previous unmapped geologic structures on targets for exploration for oil, copper, uranium, and other minerals. From an environmental standpoint they can monitor stripping operations and other changes. The geologists are now in the front line of the mining industry with their capabilities of utilizing geological remote sensing data from space. As the requirements increased for greater tonnages and lower costs for minerals, metals, and oils, the exploration techniques have been expanded and refined to meet the demands. Geology is having its day!

The success of the ancient mines lay in finding high-grade ores or having low cost labor to cob out highgrade. In many cases parts of the basic mining methods continue today, but much improved. Rock breaking has gone from fires, lime expansion, and black powder, to dynamite and now the widely used ANFO, ammonium nitrate with oil. Hand drilling, some of which I did, now to highly automated jumbos. Longwall mining came into coal mining, and rotary drills into salts operations, as well as driving adits, and in some cases, shafts. Ore transport from baskets to animals, rail, wheeled vehicles, and conveyors. Pumping from hand buckets to Cornish pumps, and today the multistage centrifugals. Refrigeration in the mines, and use of frozen shafts for Canadian potash recovery are more recent advances. Strip mining has supplanted underground recovery where deposits are too thin or low-grade and removal of the overburden is economical. Speed and low costs are still the name of the game, and where applicable, solution mining can frequently meet these requirements.

Areas were observed in Cyprus in which the Romans probably used slaves to hand sort highgrade, possibly by sight or gravity. In later years, hand sorting was practiced in a South African gold mine with high speed sorting belts passing rows of sorters. Later, colorometric and radiation sorters have been developed and seen abroad.

Process and unit operations concepts, some of which were brought in from chemical engineering, have significantly affected the approaches to methods of mineral recoveries and plant design. In the comminution field where we strive to achieve maximum liberation of values at the most economic screen size, the equipment has remained quite conventional except, possibly, for the autogenous mills. Screening, too, is much unchanged, but cyclones have replaced many of the rake and screw classifiers in recent years. Heavy media upgrades great tonnages of gravel as well as other minerals, such as in the lead/zinc industry. High volume separation of heavy minerals in beach sands has gone to Reichert cones. These are used to recover uranium and baddeleyite from the copper plant tailings at Palabora, South Africa, displacing spirals. Flotation practice has advanced to larger and larger cells, and improved efficiency at lower reagent consumptions. One of the most recent developments is the Jameson cell. Heap leaching of copper, gold, and uranium ores is the secret for much of the success enjoyed in the industry. Copper has gone from precipitation on metal scrap to sophisticated ion exchange and electrolysis methods. Chemistry and chemical control methods, pH, et cetera, is holding its own and biochemical reactions are coming to a forefront.

Smelting in ancient times, on Cyprus and elsewhere, used wood based fuels, natural draft supplemented by high winds as in Aqaba, and man or beast drive bellows. Today we are rapidly advancing to the Outokumpu continuous flash furnace for copper, using supplemental oxygen and producing a rich sulfur dioxide gas which can go directly to sulfuric acid manufacture, with the product going to leaching or to fertilizers, thereby eliminating a great environmental problem.

Metal refining has been high mechanized, as has extrusion and wire drawing practices. A far cry from the days of wooden ships with copper cladding as practiced at Nelson's Dockyard in Antigua in the 1770s, which may have used copper originating at the old copper mine observed in Virgin Gorda in 1992. They probably never dreamed that the trace of molybdenum sulfide observed in a rock sample would someday be the basis for an industry producing metal for alloys and superlubricants. Combinations of exotic metals used in the computer, medical, and aviation industries, and requiring great precision in their isolation and refining, are everyday affairs in the metallurgical fields.

It appears in recent years that the importance of the fields of mining and metallurgy are being deprecated by many who do not realize their importance in our life and economy. These basic industries support the service economies so highly touted by the media. Deductive reasoning is

the name of the engineering game; where for many other disciplines the syllogism is the subtle, specious, or crafty approach which is frequently lauded and often far better rewarded. Mining and metallurgy using the tools of scientific exploration, research, design, and construction, support investments and create wealth; the obligation of the industry is to do so ethically, with integrity, and understanding.

Further on the Effects of Computers in the Mining Industry

One of the most significant recent developments in the industry is that of computer technology. Starting originally with the computation of heat and material balances in the process plants, it rapidly found great use in drafting of plant plans, mine layouts, wiring and piping details, et cetera. Estimating, material control, scheduling, and operations manuals were expedited. Plant process control is now highly developed, with TV monitoring widespread. All these are assisted by computer inputs, with greater accuracy and great savings.

In the economic analysis group with which I was associated, we prepared EEIs (Essential Elements of Information) programs so a large petroleum company could rapidly evaluate submittals of properties or mining projects that had been submitted to them. By entering the EEI in these computer programs, a rapid analysis would divide such projects into good, bad, or indifferent categories. Only a good result would warrant further follow-up. Should such occur, a more detailed and better defined analysis served to confirm if the project was in their area of interest.

Bankers, who ask the question, "Will it work? Will it pay?" look to the cash flows, and these spreadsheets are rapidly made up by computers, accurate, and easily understandable.

THE SIGNIFICANT CHARACTERISTIC OF THE WORLD TODAY IS CHANGE!!

James H. Jensen

San Mateo, California
January 8, 1993

APPENDIX B

Publications, Papers, and Presentations

Benson, Henry K., et al. "Potential Industries of the Columbia River Basin."--Phosphate Section, by J.H. Jensen. Published by University of Washington, 1937.

Jensen, J.H., "Calcium Carbide for Northwest Industries." Presented at Regional AIME meeting, Spokane, WA, May 1949. Also, Review of the Western Calcium Carbide Industry," presented at the AIME meeting in Trona, CA, 1955.

Jensen, J.H., "The Importance of New Methods of Recovering Sulfur." Presented at Regional AIME meeting in Los Angeles, CA, 1954.

Lassiter, R.T. and Jensen, J.H., "New Trends in Plant Design." Presented at the American Mining Congress Meeting, San Francisco, CA, September 22, 1958, and Mining Congress Journal, Vol. 44, June 1959.

Jensen, J.H., "Getting into Operation." Student Mineral Processing Seminar, Stanford University, February 23, 1961.

Jensen, J.H., "Deepest Open Pit Saline Deposit in the World." Presented AIME San Francisco Section meeting of October 9, 1963 (Dead Sea Data).

Nylander, A.F. and Jensen, J.H. "Magnesium Choride [chloride?] from Naturally Occurring Brines and Evaporites." Mining Engineering Vol. 16, Nov. 1964. Also in Journal of Metals Sept. 1964, and paper presented by J.H. Jensen at 93rd AIME Annual Meeting.

Jensen, J.H. "Personnel Needs of Engineering and Construction Companies in the Mining Industry." Panel Discussion--Students' Night, San Francisco Section AIME, November 13, 1967.

Jensen, J.H. "The Preparation and Use of Capital Cost Estimates for Mineral Projects." Pacific Southwest Mineral Conference AIME, San Francisco, CA, May 27, 1970. James V. Thompson, Moderator.

Wright, Paul B. and Jensen, James H., "A Typical Evaluation of a Foreign Mining and Concentrating Project." AIME Annual Meeting, Dallas, TX, February 25, 1974.

Noyan, K., Aksoy, S., Karadeniz [?] Bakir Isletmeleri, A.A., Turkey, Jensen, J.H., Wright, P.B., Arthur G. McKee, U.S.A. "The KBI Parallel Pipelines for Sulfide Concentrates." Third International Conference on the Hydraulic Transport of Solids in Pipelines Conference sponsored by BHRI Fluid Engineering, Cranfield, Bedford, England; with Colorado School of Mines. May 15-17, 1974.

Lefond, Stanley J., Editor "Industrial Minerals and Rocks--4th Edition." 1975 AIME, Bromine Chapter by J.H. Jensen.

Jensen, J.H. and Taylor, Al, "Recent Developments in Ion Exchange Engineering." Mining Congress Journal, April 1977. Paper presented by J.H. Jensen at American Mining Congress 1976 Convention, Denver, CO, Sept. 26-29, 1976.

Jensen, J.H., "Advances en la Hidrometalurgia del Uranio," Ingenieria Quimica (Spain), Ano IX, Num. 101, August 1977.

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